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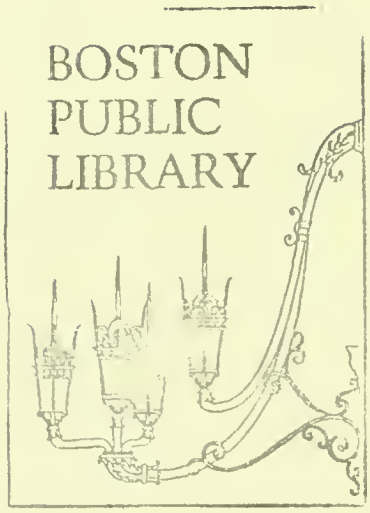
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TRANSPORTATION IMPACTS OF THE PARK PLAZA URBAN RENEWAL PROJECT

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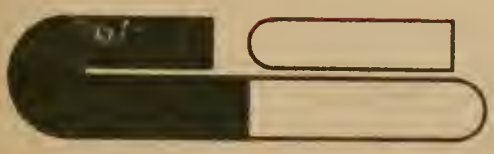

cambridge systematics, inc.

Park Plaza
C 178

JULY, 1975

FINAL REPORT

TRANSPORTATION IMPACTS
OF THE
PARK PLAZA URBAN RENEWAL PROJECT

prepared for

Boston Redevelopment Authority
City Hall
Boston, Massachusetts

by

Cambridge Systematics, Inc.
Kendall Square Building
238 Main Street
Cambridge, Massachusetts
02142

July, 1975

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July 9, 1975

Alfred R. Howard
Transportation Planning Director
Boston Redevelopment Authority
Room 900, City Hall
Boston, Massachusetts 02201

Dear Mr. Howard:

Cambridge Systematics is pleased to submit this final report, "Transportation Impacts of the Park Plaza Urban Renewal Project," representing one component of the environmental analysis currently being performed for Park Plaza. The report identifies existing transportation services and characteristics in the Park Square area of Boston; forecasts transportation conditions in 1985; estimates the trip-making behavior of Park Plaza occupants and visitors, including the modes and routes of travel utilized and the impacts which these projected new trips would have on the area's transportation facilities; and develop measures that could be undertaken in conjunction with construction of Park Plaza which would have the effect of reducing and possibly eliminating potentially adverse transportation impacts. Each of the transportation facilities that would serve the Park Plaza site area is examined: local streets and intersections, rapid transit lines and stations, commuter rail facilities, bus routes, pedestrian movements, and automobile parking.

Several key findings are apparent from the analyses which have been performed. While these are developed in detail within the body of the report, the following represents a general summary:

- The magnitudes of possible transportation imapcts are determined not only by the overall density of the development but also by the particular mix of activities within a given density, the capacity of the parking facility provided, and the location of the parking access and egress ramsp. For example, the forecasted transportation effects of the five million square feet development are more severe than those associated with the six million square feet alternative because of the larger population of office employees in the five million option.

- The rapid transit, commuter rail, and bus systems serving downtown Boston should have more than adequate capacity in 1985 to easily absorb even the largest projected increment of Park Plaza trips. The Green Line will be the MBTA facility most directly affected and even here, no serious problems are anticipated assuming the new light rail vehicles and associated improvements now being implemented provide even a fraction of their scheduled increase in capacity.

- The most serious transportation impacts, for each of the five basic density alternatives, are likely to occur on the local streets surrounding Park Plaza, and on the major access and egress routes serving the area. Several intersections currently experience heavy congestion during periods of peak travel and these can only become worse unless a well-defined program of traffic flow improvement measures are undertaken in conjunction with the development of Park Plaza. Potentially the most significantly affected are the intersections at Columbus-Arlington-Stuart and Dartmouth-Columbus in the morning peak; and at Beacon-Arlington, Columbus-Arlington-Stuart, Dartmouth-Columbus, and Beacon-Berkeley during the evening peak. However, changes to the timing and phasing of traffic signals, combined with pedestrian circulation and other local street improvements should be sufficient at all intersections to eliminate a condition of traffic demand exceeding available capacity, except at Columbus-Arlington-Stuart for the 6, 5, and 4 million options. At this location with the larger density options, a more major redesign of either the street system or Park Plaza itself is necessary if frequent congestion and queueing is to be avoided. The principal reason why the Columbus Avenue-Arlington Street-Stuart Street intersection is potentially the most seriously congested is that traffic from four of the six major corridors will pass through this set of signals - the north, northwest, west, and southwest.

- Adequate parking supply is available within convenient walking distance of Park Plaza to handle projected shopping, employee, and hotel parking demands for all alternatives, assuming spaces within Park Plaza are not allocated exclusively to a single purpose. The planned Park Plaza parking facility, however, will be sufficient by itself only for the 2 million option. The parking deficiencies are most serious with the 4, 3, and 5 million densities, with parking demand exceeding supply throughout the day with the 4 and 3 million options. The potential problems with the middle range of density alternatives result from the smaller parking capacities that are scheduled to be provided, and imply an increase in demand for parking in nearby facilities, such as the Boston Common Underground Garage and on nearby streets.

- A key to the minimization of potential traffic congestion problems on the streets immediately adjacent to the site is the provision for high quality east-west and north-south pedestrian movement and the separation of pedestrian and vehicular traffic. This is most important for all crossings of new Charles Street.

- The further design and development of Park Plaza should account for the specific measures described in Chapter VII regarding improved parking access, parking operation, modal choice incentives and disincentives, local street circulation, management of work hours, and intersection signalization. Some measures are desirable even with the 2 million density, but become increasingly necessary with the larger alternatives. These measures are designed to eliminate or minimize potentially adverse transportation impacts and include actions such as the provision of additional parking access from the western side of Park Plaza. In developing these measures, it is recognized that the proposed westbound

connector - Eliot Street and new Providence Street - passing through Park Plaza will serve as both a primary egress route and a means of westbound movement for non-Park Plaza based trips.

In performing the transportation related investigations, we have taken care to maintain consistency with other components of the environmental analysis and with data furnished to us by the BRA. Major assumptions and areas of uncertainty are identified in Chapter VI of the report. As a general guideline, we chose assumptions which are conservative, yet realistic, in their implications. Occupancy of Park Plaza is assumed to occur in 1985. No special allowances have been made for either the planned Statler-Hilton improvement program or for the new state office building. The state office building, in particular, would likely have different population characteristics than those assumed in the presented analyses, and consequently different traffic and parking implications.

The study has been performed by Dr. Paul O. Roberts, Mr. James A. Wojno, Dr. Wayne M. Pecknold and myself. Dr. Roberts had primary responsibility for those portions of the effort concerning the local streets; Dr. Pecknold was responsible for transit related components; and Mr. Wojno performed the associated data analyses. I have been responsible for the overall direction and coordination of the study effort, including preparation of the final report.

The cooperation and assistance provided by representatives of the City and Commonwealth in providing data and guidance is deeply appreciated. Their active participation has enabled us to complete this investigation in the time available.

We are pleased to have had this opportunity to assist the Boston Redevelopment Authority in this important and exciting project. We believe the various analyses that have been performed provide an insight into how the transportation system of downtown Boston would be affected by each of the proposed Park Plaza alternatives, and that the results will be of significant assistance to City and Commonwealth officials in performing their decision-making responsibilities.

Sincerely yours,

John H. Suhrbier

CAMBRIDGE SYSTEMATICS, INC.
John H. Suhrbier
Project Director

JHS:CW

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I. Introduction

A. Transportation Impacts

The introduction of a major and large new activity center, such as is represented by the Park Plaza Urban Renewal Project, into the core area of Boston has the potential to impact the operation of the city's transportation system - the network of expressways, local streets, intersections, sidewalks, parking facilities, bus routes, light rail and rapid lines, and commuter rail facilities which employees, shoppers, and visitors utilize in making trips within the downtown area. The transportation analysis undertaken by Cambridge Systematics, Inc. and reported on herein represents one component of a larger environmental study and has included the following tasks:

1) to identify existing 1975 transportation services and characteristics, including the identification of current problems;

2) to forecast base year transportation conditions in 1985, the year Park Plaza is scheduled to open for full occupancy;

3) to forecast the trip making behavior of Park Plaza occupants and visitors;

4) to estimate the modes of travel of people to Park Plaza for different trip purposes, and the impacts which these projected new trips would have on the area's transportation facilities;

5) to identify measures that can be undertaken in conjunction with the development of Park Plaza which would have the effect of reducing and possibly eliminating potentially adverse impacts; and

6) to determine an upper limit on the size of Park Plaza beyond which transportation impacts would be so severe that developments above this scale should not be constructed.

The study has been intended to both update previous Park Plaza transportation related studies and to examine potential impacts in more depth than in previous studies. Given the history of previous Park Plaza submissions, the inherent complexity of this area of downtown Boston, and the close professional and public scrutiny to which Park Plaza information is being subjected, the study has carefully adhered to existing knowledge of travel behavior, utilized disaggregate data rather than areawide averages, and utilized an analysis methodology which approximates as closely as was possible within the time and resources available the equilibrium condition of traffic operations. Major assumptions and areas of uncertainty in the analysis are discussed as Chapter VI.

B. Park Plaza Urban Renewal Project

The proposed Park Plaza site area is located adjacent to the south side of the Boston Public Garden and the Boston Common, approximately mid-way between the Back Bay and the existing downtown core. The site is bounded by Boylston Street, Tremont Street, Stuart Street and Arlington Street (Figure II-1). Five alternative construction programs are currently under consideration varying in size from a minimum of 1,992,892 square feet to a maximum of 5,874,356 square feet. Intermediate options are defined at 3,007,006, 4,035,291 and 4,957,075 square feet.* These five alternatives are commonly referred to by their approximate size: 2, 3, 4, 5, and 6 million square feet.

Each alternative involves a mix of retail, office, apartment, hotel, parking, and open space and is fully defined by the two B.R.A. memoranda:

- "Defining the Alternatives, Park Plaza E.I.S.", February 4, 1975.

- "Park Plaza Density Alternatives: Additional Information", April 7, 1975.

To give an idea of the scale, apartment units vary in number from 320 to 1645, office space from 882,109 to 1,826,969 square feet, retail space from 141,545 to 351,965 square feet, hotel rooms from 406 to 812 (no new hotel is included in the 2 million option), and parking from 1400 to 3131 spaces.

The amount of land required varies with each alternative. The 2 million option is generally regarded as the "no-build" alternative since new construction would be limited to existing vacant lots, and not involve the demolition of any existing buildings. On the other hand, the 6 million option requires acquisition of the entire site area except the Statler Hilton complex on Arlington Street and the Little/Colonial/Walker Building located at the corner of Boylston and Tremont Streets. A more complete definition of major Park Plaza parcels and sub-parcels is contained in the B.R.A.'s memorandum of January 9, 1975 to the Park Plaza Civic Advisory Committee.

The Massachusetts Department of Community Affairs on March 5, 1974 ruled that an environmental impact analysis of the Park Plaza Urban Renewal Plan must be submitted to the Commissioner of the Department of Community Affairs and then to the Secretary of the Environment prior to the commencement of any development activities. The environmental analysis responding

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* The 3,007,066 square feet option is a revised version of the earlier 3,766,687 square feet alternative.

to this requirement is being performed by The Saratoga Associates, in cooperation with the Boston Redevelopment Authority and the Park Plaza Civic Advisory Committee. This transportation study constitutes one component of the larger environmental analysis. The environmental analysis is to identify the impact of each stage of development activity on the natural, physical, social and economic areas of the environment. Major sections of the work include an environmental data base to provide a means of measuring the impacts, and a development program interpretation to provide a means of identifying the cause of each impact.

C. Analysis Methodology

The analysis steps followed, and the structure of this report, closely parallel the six identified objectives.

- Data on existing services and characteristics were collected and analyzed for expressways, local streets and intersections, rapid transit, commuter rail, local and commuter bus, parking, and pedestrian movements. This information is summarized in Chapter II, including an assessment of current problems.

- Trips to be generated by each of the five Park Plaza alternatives were estimated based on Park Plaza population data developed by Economic Research Associates and by the B.R.A. Trips were estimated by time-of-day for each of seven trip purposes: office employee, office visitor, residential, retail employee, shopper, hotel employee, and hotel guest. Trips were then allocated to one of eight travel "corridors" - on-site, within downtown, northeast, north, northwest, west, southwest, and southeast - and assigned to specific modes, routes and stations or intersections. This information is discussed in Chapter IV, with the detailed findings of the analysis presented in Chapter V.

- Because the focus of the study is on the identification of the transportation impacts of new Park Plaza trips in 1985, several additional analysis steps were necessary. These include the following:

  - Trip generation is based only on population to be associated with the new development in order to assess the effects of this increase.

  - Modal usage is extrapolated to 1985 based on population and employment forecasts for the downtown area, other committed new developments, and historical traffic volume data.

  - Capacities of transportation services available in 1985 are estimated based on currently committed, but not yet implemented, transportation improvements.

- Allowance is made for existing trips generated from within the Park Plaza site area that will be displaced by Park Plaza.

- Allowance is made for new Park Plaza bound trips that may represent a relocation of existing trips from within the downtown area rather than entirely new trips.

The data supporting these analyses is contained in Chapter III.

- Analysis of parking supply and demand is based on an estimate of total automobile vehicles arriving at and departing from Park Plaza by time of day. The analysis methodology is similar to that employed in the modal assignments except that the trips represent total Park Plaza related trips from the entire site area, not just trips to be generated by the new development. The results of this analysis are presented as part of Chapter V.

- The last step in the analysis is the identification of possible mitigating measures. These are described in Chapter VII and are based on analysis of the existing data, results of the traffic analyses, analyses of the Park Plaza plans themselves, and discussions with Boston transportation officials.

The transportation analysis has been performed on the basis of existing data available from the Boston Redevelopment Authority, the City of Boston Traffic and Parking Department, the Executive Office of Transportation and Construction, the Massachusetts Bay Transportation Authority, the Massachusetts Department of Public Works, and the Central Transportation Planning Staff. New data collection has been limited to that which could easily be obtained from field observation. In performing the study, no data deficiencies were identified as being sufficiently serious to negate the validity of this portion of the environmental analysis.

II EXISTING TRANSPORTATION SERVICES AND CHARACTERISTICS

Basic to the estimation of transportation impacts for each of the Park Plaza alternatives is determination of currently available transportation services and characteristics. This chapter identifies the transportation modes and corridors that would serve a Park Plaza development. For each mode, a brief description is provided of existing services or facilities, schedules, existing volumes, existing capacity, and an assessment of current problems. Changes in modal usage over time are examined in Chapter III, along with an identification of transportation improvements scheduled for implementation between 1975 and 1985. Data on the distribution of Boston-oriented travel by mode and by corridor are provided in Chapter IV.

A. Access to Park Plaza Site

Modal Services

Park Plaza, because of its location between the heart of downtown and the Back Bay, will be conveniently served by all available transport modes:

Expressways
Local Streets
Rail Transit
Commuter Rail
Local and Commuter Bus
Walking

The site is directly served by the M.B.T.A. Green, Orange, and Red Lines with six stations in the nearby vicinity: Arlington, Boylston, Essex, Park Street, South Cove, and Back Bay, the latter two being new Orange Line stations. In addition, the site is within one quarter mile walking distance of Penn Central commuter rail service and of commuter bus service. Direct subway connections are possible with both the Blue Line and with Boston and Maine commuter rail service at North Station; for example, rail commuters from the north can use either the Orange Line or the Green Line to travel to Park Plaza. The site area presently is served directly by two local M.B.T.A. bus routes and is approximately one third mile from the planned new South Station transportation terminal.

Because of the site's location relative to the Back Bay, Beacon Hill and South Cove residential areas and to the commercial center of downtown Boston, walking will be convenient from each of these areas to Park Plaza. It can be expected, therefore, that a higher than normal percentage of both home-to-work and visitor trips to Park Plaza would be pedestrians.

With respect to expressway and automobile access, Park Plaza is centered

among the five major facilities serving the downtown area: the Massachusetts Turnpike, Storrow Drive, Interstate 93/Mystic River Bridge, the Sumner/Callahan Tunnels, and the Southeast Expressway (Figure II-1). The majority of Park Plaza bound automobile trips from outside the city will enter the cordon on one of these routes.

Modal Routings

Travel to and from Park Plaza will be from the site area itself, from other portions of the downtown area, or from one of the six major access corridors defined in Figure II-2. These corridors correspond with major highway, rail transit, and commuter rail routes serving the Park Plaza site and have been used as the basis for almost all transportation studies conducted in recent years in the Boston region. As displayed in Chapter IV, data are available giving the relative distribution of both employee and non-employee trips generated by each of these six corridors. In addition, historical modal split data are available by corridor so that actual trip making behavior can be more closely approximated than if region-wide figures were used.

Park Plaza trips that are internal to the site area itself, e.g. trips from an apartment complex to an office tower, are assumed to be an internal pedestrian movement and are not considered as part of this analysis.

Trips between Park Plaza and other parts of the downtown region are assumed to be either pedestrian or rapid transit. For convenience, all transit travel of this type is assumed to use the Green Line.

For trips from outside the downtown area, street, rapid transit, and commuter rail routings can be defined for each of the six defined access corridors. One or at most two specific routings are defined for each mode from each corridor. In reality, more options are available to an individual traveller, and will be used. However, this approximation was made to help focus the analysis on the identification of the most severe impact areas.*

Principal inbound and outbound highway routes serving Park Plaza are defined in Figure II-3 and II-4. The following assumptions are made:

- northeast corridor traffic will use the Sumner/Callahan Tunnels and Stuart/Kneeland Streets.

- north corridor traffic will utilize I-93 and Storrow Drive. Entrance will be by Beacon Street and then either Arlington or Clarendon Streets to Stuart Street. Exit will be by Charles Street and Storrow Drive.

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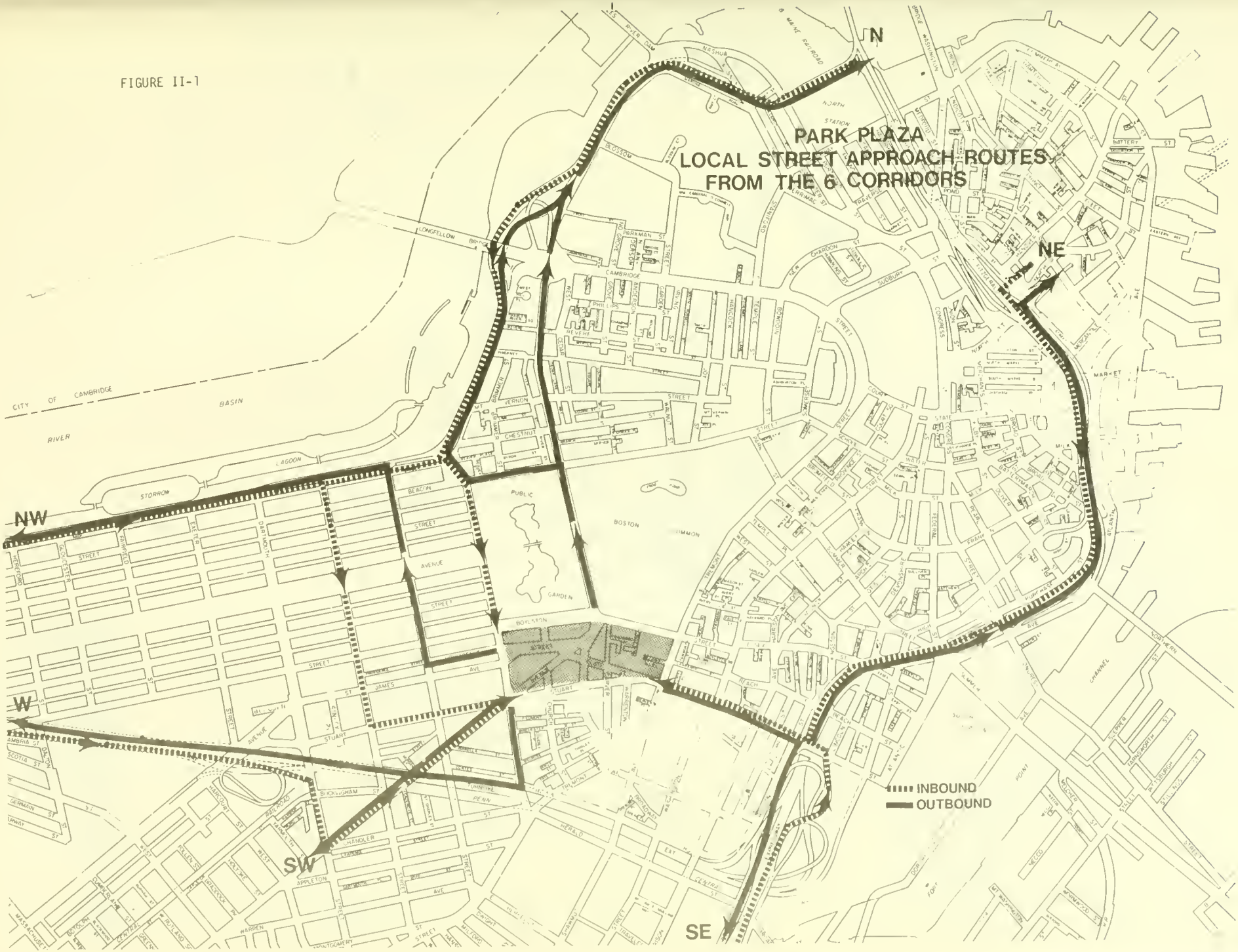
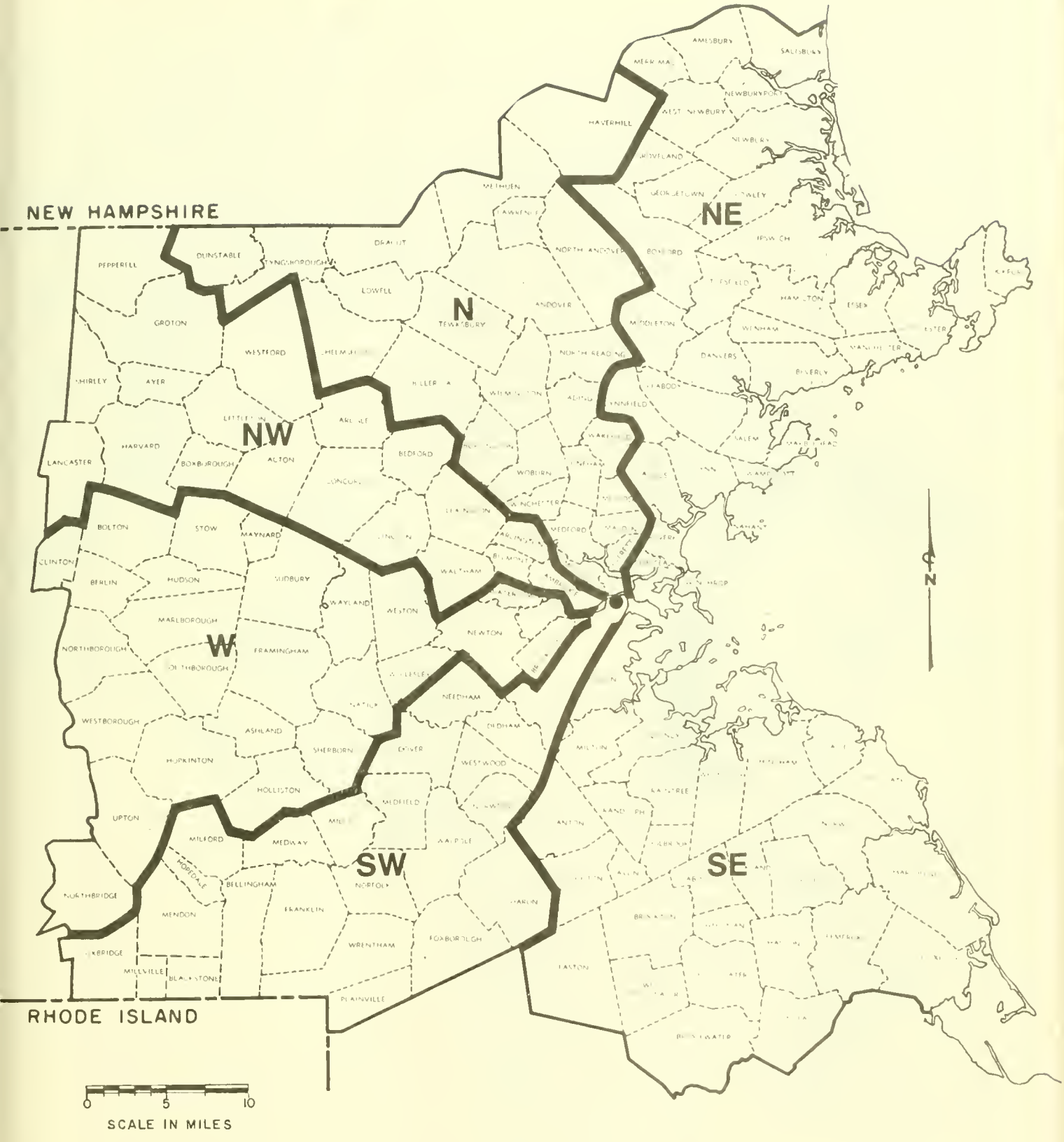
*The implications of this assumption are discussed in greater detail in Chapter VI.

FIGURE II-1


PARK PLAZA
LOCAL STREET APPROACH ROUTES
FROM THE 6 CORRIDORS
N
NE
NW
W
SW
SE
INBOUND
OUTBOUND



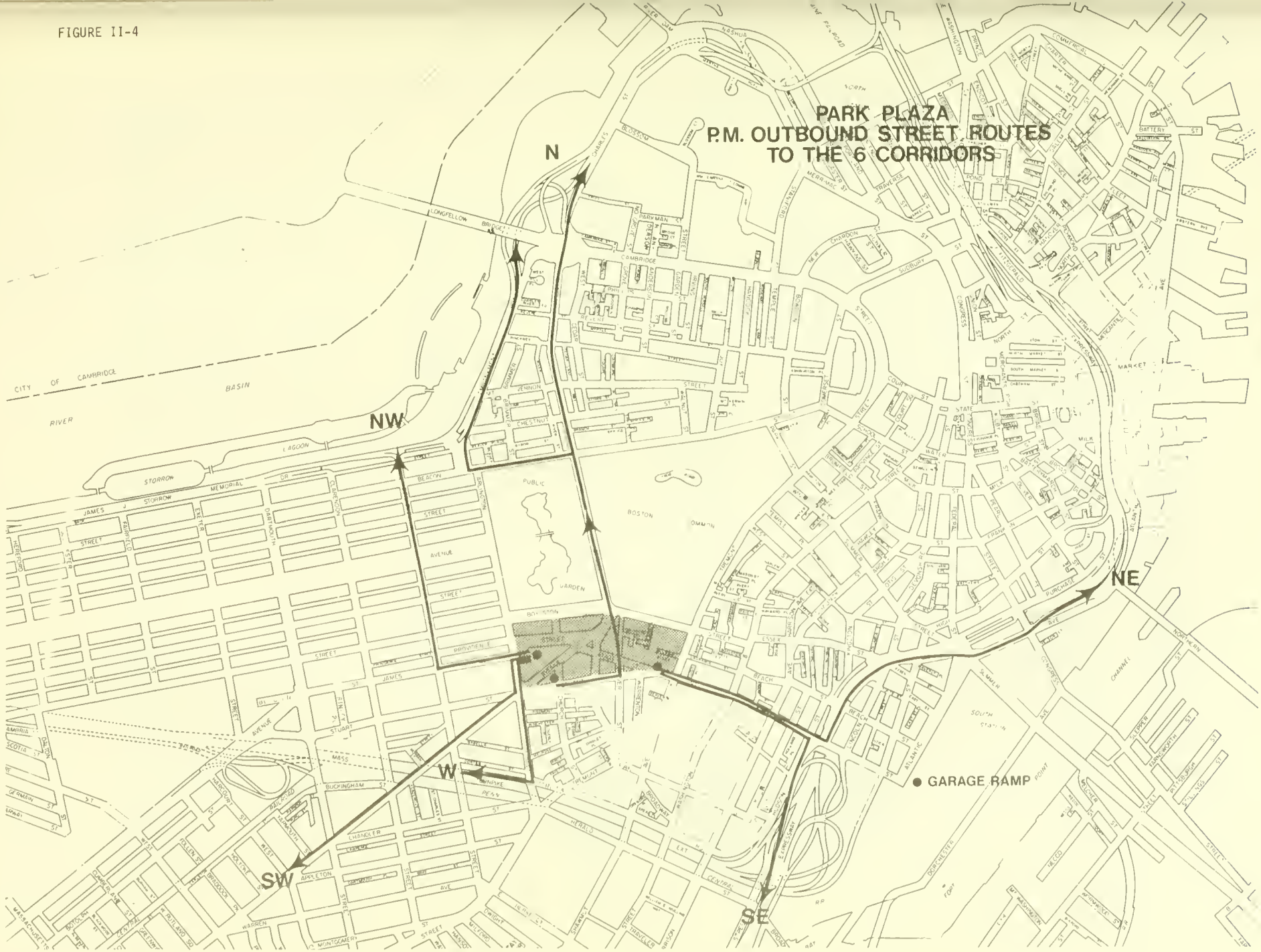
SIX CORRIDORS USED FOR TRAVEL TO PARK PLAZA

FIGURE II-2

FIGURE II-3

PARK PLAZA
A.M. INBOUND STREET ROUTES
FROM THE 6 CORRIDORS
N
NW
W
SW
SE
NE
● GARAGE RAMP
CITY OF CAMBRIDGE
RIVER
BASIN
LAGUON
LONGFELLOW BRIDGE
CHARLES
CAMBRIDGE
REVERE
VERNON
CHESTNUT
STORROW
JAMES
PUBLIC
GARDEN
BOSTON
COMMON
STATE
WATER
MARKET
CHANNEL
MASS
BUCKINGHAM
PARK
BEACON
TREMONT
SUDBURY
CONGRESS
BATTERY
NORTH
COMMERCIAL
TRAVERSE
MERRIMAC
CHARDON
PARKMAN
MAINE RAILROAD
WASHINGTON
PROVIDENCE
AVENUE
STREET

FIGURE II-4


PARK PLAZA
P.M. OUTBOUND STREET ROUTES
TO THE 6 CORRIDORS
N
NW
W
SW
SE
NE
GARAGE RAMP
CITY OF CAMBRIDGE
RIVER
BASIN
LONGFELLOW BRIDGE
CHARLES
CAMBRIDGE
BOSTON COMMON
PUBLIC GARDEN
STORROW MEMORIAL DR
BEACON STREET
MASS AVE
BOYLSTON
PARK PLAZA
ARLINGTON
CHARLESGATE
STATE
MILK
WATER
CONGRESS
SUMMER
ATLANTIC
NORTHERN
CHANNEL
SOUTH STATION
BUCKINGHAM
PENN
HERALD
APPLETON
WARREN
MONTGOMERY
CENTRAL
DORCHESTER
FORT
BROADWAY
EXPRESSWAY

- northwest traffic will use Route 2, Storrow Drive, and Clarendon Street. Exit will by by St. James Avenue and Berkeley Street.

- west corridor traffic will be on the Massachusetts Turnpike, arriving from the Prudential Center exit, Dartmouth Street and Columbus Avenue. Outbound travel will use the Arlington Street entrance ramp to the Turnpike.

- southwest corridor traffic will use Columbus Avenue.

- southeast traffic will be from the Southeast Expressway and Stuart/Kneeland Streets.

The different inbound and outbound routings result from the pattern of one-way streets serving the area. Also, the street routings heavily depend on the location of the parking garage entrance and exit ramps. It is assumed that entrance is possible from Stuart Street as well as new Eliot Street, and that exit can be onto Stuart Street, new Eliot Street and Tremont Street.

Rapid transit routings inbound to and outbound from Park Plaza for each of the six defined corridors are defined in a similar manner to the auto routings and are displayed in Figure II-5. In each case, the outbound routing is assumed identical to the inbound route.

- northeast; Blue Line with transfer to Green Line at Government Center and exit at Boylston Station. While not included in the analysis, some trips will choose instead to transfer to the Orange Line with exit at Essex Street.

- north; Orange Line to Essex Street.

- northwest; Red Line with transfer to Green Line at Park Street and exit at Boylston Street. Some trips also will use Arlington Station or may choose to walk from Park Street; the analysis assumes, however, a 100% transfer to the Green Line.

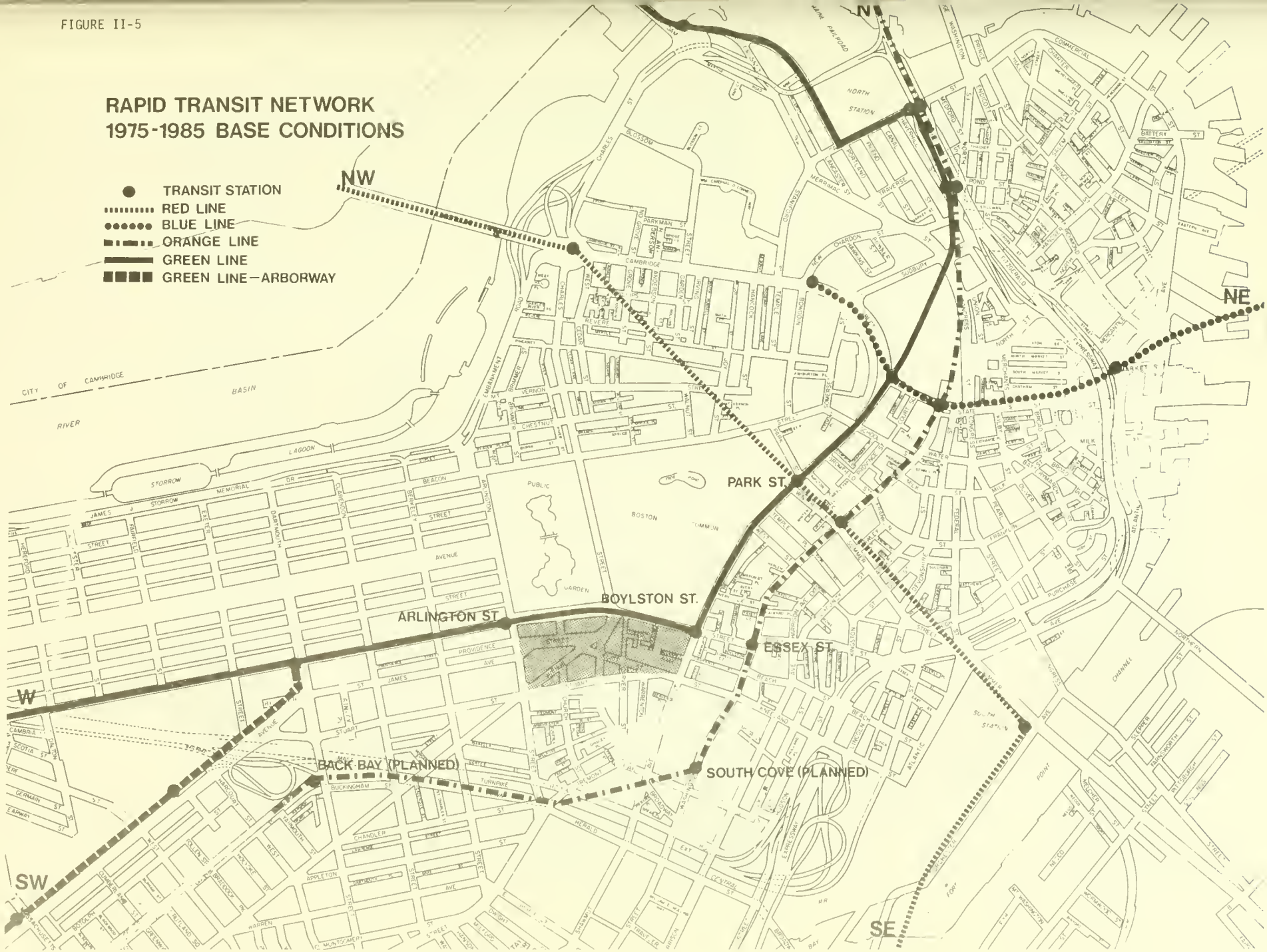
- west; Green Line to Arlington Street.

- Southwest; Orange Line to new South Cove Station. Some trips also likely to use new Back Bay Station.

- southeast; Red Line to Park Street with transfer to Green Line and exit at Boylston Street.

Commuter rail service to Boston is provided by the Boston and Maine system to the north and northwest and by the Penn Central system to the south and southwest. Both systems are now operated by the M.B.T.A. The Boston and

FIGURE II-5


RAPID TRANSIT NETWORK
1975-1985 BASE CONDITIONS
TRANSIT STATION
RED LINE
BLUE LINE
ORANGE LINE
GREEN LINE
GREEN LINE—ARBORWAY
NW
N
NE
W
SW
SE
PARK ST.
BOYLSTON ST.
ARLINGTON ST.
ESSEX ST.
BACK BAY (PLANNED)
SOUTH COVE (PLANNED)
CITY OF CAMBRIDGE
RIVER
BASIN
LAGOON
BOSTON
COMMON
PUBLIC
GARDEN
NORTH STATION
SOUTH STATION

Maine service is through North Station and will handle commuter rail traffic from the northeast, north, and northwest corridors. These passengers are assumed to transfer equally to the Orange and Green Lines to reach Park Plaza. The Penn Central system will serve commuter rail traffic generated from the west, southwest, and southeast corridors. Exit is assumed to be at Back Bay Station with a quarter mile walk to Park Plaza, rather than at the line's terminus at South Station.

B. Expressways

An examination of traffic dynamics in downtown Boston must examine the operation of highway flows at two separate levels:

- at the macro level, the expressway system utilized by half of all traffic destined for the CBD, and

- at the micro level, the local street system which serves as the distribution network once automobiles arrive in the downtown area.

At the present time, expressway access to Boston from the northeast, north, northwest, and southeast can be characterized as being heavily congested during both the morning and evening peak periods. The Massachusetts Department of Public Works reported 1972 average daily traffic flows were 82,000 - 121,000 for the Central Artery, 52,000 for the Massachusetts Turnpike, 64,000 for the Sumner/Callahan Tunnels, and 84,000 - 88,000 for Storrow Drive. In several cases, there are isolated points of stop-and-go conditions, such as the Mystic River Bridge and the merger of I-93 with the Central Artery. The effect of this condition in the morning is that the congestion points serve to control or meter the flow of vehicles onto the local street system, spreading the peak flows over time and reducing congestion on the local streets. Also, drivers themselves vary their travel times to avoid periods that are likely to be heavily congested, again resulting in a spreading of the peak and a lessening of local street flows.

A similar effect exists in the evening, although of course the expressways can no longer serve as metering devices for vehicles flowing onto the local street system. Still, there are points of heavy daily congestion on the expressway ramps and bridge approaches which lengthen the evening peak by changing departure times.

The hypothesis postulated is that several of the major access expressways are presently flowing at or near capacity and serve to limit auto traffic entering the downtown local street system. Without major expansion of the expressway system, which is not probable under the current highway moratorium, it is likely that traffic on the local street system will increase at a slower rate than it would if the expressways were not already congested. In the past, growth in traffic destined to the CBD has been

handled by providing increased highway facilities. Interstate 93, the Callahan Tunnel, and the Massachusetts Turnpike are examples of facilities which have been added in recent years to increase highway capacity. Now, with the highway moratorium, the total expressway capacity has finite limits, and new traffic is handled by a lengthening of the peak period.

C. Local Streets and Intersections

While the natural tendency is to think of local street conditions as flows of vehicles on streets, the critical determinents of capacity - and therefore of congestion - are the intersections, not those portions of the streets lying between intersections. If even one or two intersections are unable to handle the demands for turning movements and corssflows placed upon them, it is likely that congestion will rapidly spread from these isolated spots to numerous other areas. Field investigations indicate that several such critical intersections exist under present conditions in the Park Plaza area; including Boylston and Arlington Streets; Columbus, Stuart, and Arlington Streets, Boylston and Tremont Streets, and Tremont and Stuart Streets. Once congestion begins to form at one of these points, the queues may back up and block other intersections. It is for this reason that the analysis of Park Plaza impacts on local street traffic focuses on intersections potentially most severely impacted.

Traffic count data was obtained from the Boston Department of Traffic and Parking and used to prepare the maps of existing A.M. and P.M. peak flows illustrated in Figures II-6 and II-7. The most recent counts varied in date from 1967 to 1972 and included counts of individual turning movements at each intersection.* These data were than balanced and used as the basis for Figures II-6 and II-7.

Using existing traffic signal timing information and the number of moving traffic lanes for each intersection, estimates of existing intersection capacity were calculated using the Yale Bureau of Highway Traffic methodology. The results are presented in the tables contained in Chapter V in terms of hourly capacities of vehicles. The differences between the existing volumes and capacities gives an indication of the slack that is available in the system at the present time during the morning and evening peak hours. A saturated condition exists where the volume is close to or greater

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* Analysis of cordon count data during this period indicates a period of relatively stable traffic conditions. Given that the objective of this study is a determination of the likelihood of potentially adverse transportation impacts and not the timing of individual traffic signals, both the date and time spread of these counts are satisfactory for this analysis.

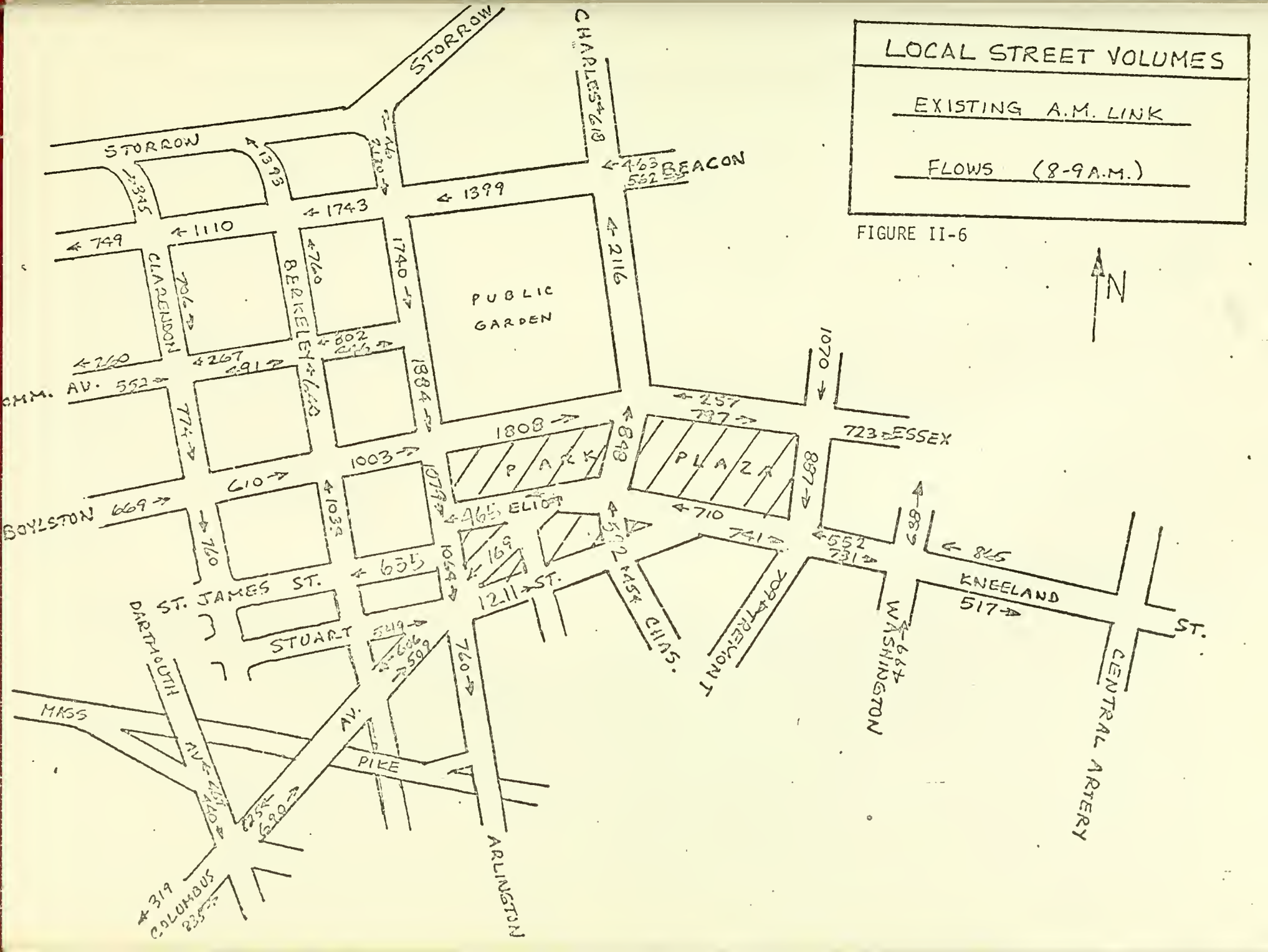
LOCAL STREET VOLUMES
EXISTING A.M. LINK
FLOWS (8-9 A.M.)
STORROW
CHARLES
BEACON
CLARENDON
BERKELEY
PUBLIC GARDEN
PARK
PLAZA
ESSEX
COMM. AV.
BOYLSTON
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV.
PIKE
ARLINGTON
CHAS.
TREMONT
WASHINGTON
KNEELAND ST.
CENTRAL ARTERY
N

FIGURE II-6

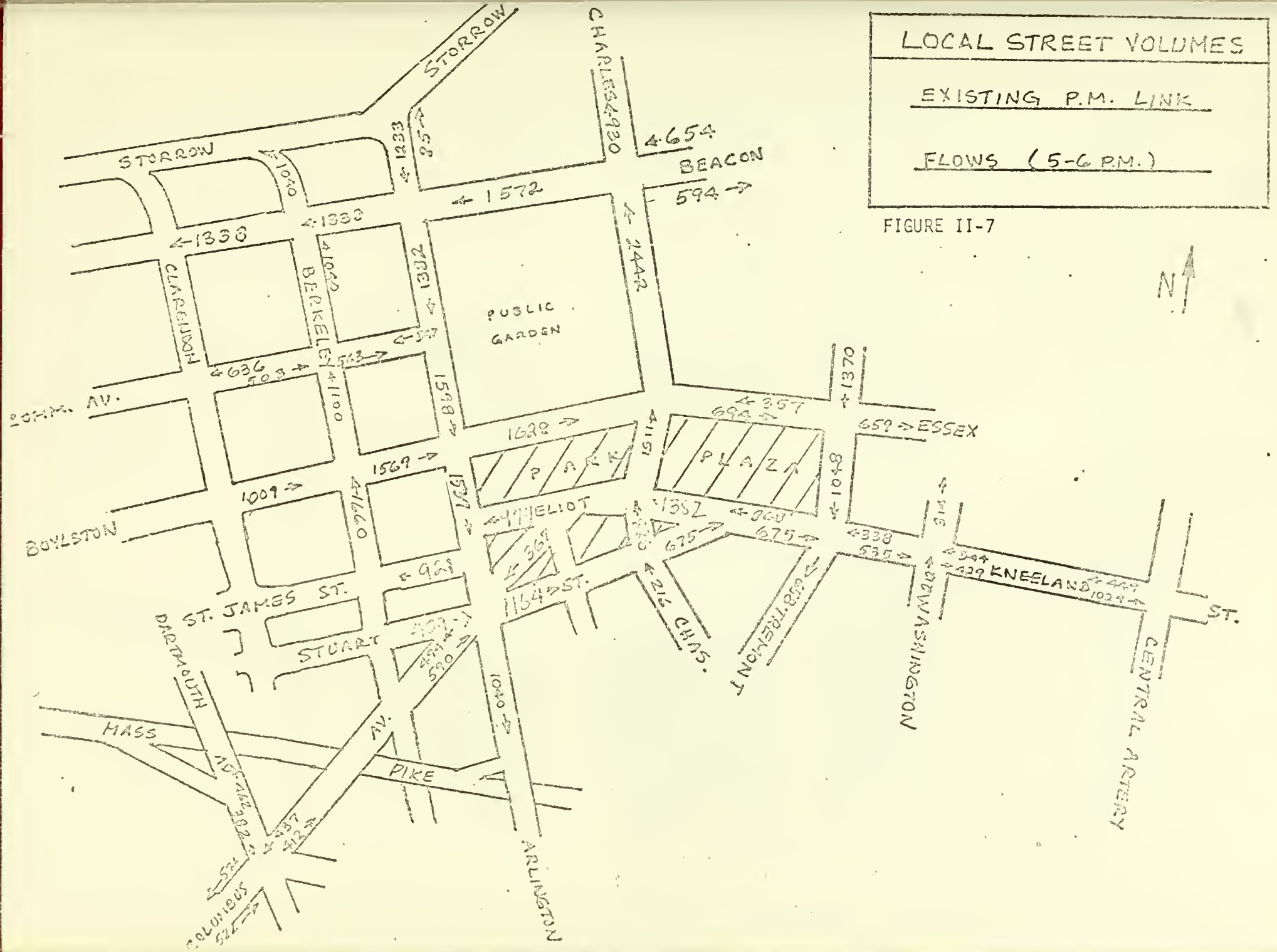
LOCAL STREET VOLUMES
EXISTING P.M. LINK
FLOWS (5-6 P.M.)
STORROW
CHARLES
BEACON
CLARENDON
BERKELEY
PUBLIC GARDEN
COMM. AV.
BOYLSTON
ST. JAMES ST.
STUART
ELIOT
PARK PLAZA
ESSEX
DARTMOUTH
MASS AVE
PIKE
ARLINGTON
CHAS.
TREMONT
WASHINGTON
KNEELAND
CENTRAL ARTERY
COLUMBUS
N

FIGURE II-7

than the calculated capacity. The following intersections potentially affected by Park Plaza, in addition to those identified above, have existing volume/capacity ratios approaching 1.0 for one or more directions of movement, with queues forming under periods of particularly heavy flow.

Beacon - Arlington
Columbus - Dartmouth
Charles - Beacon

D. Rapid Transit

Capacity of the M.B.T.A. transit system serving Park Plaza can be limited by either line capacity or station capacity. While a preliminary analysis and examination of historical trends indicated that the limiting factor would be one or more of the individual lines rather than the stations, both lines and stations have been examined. Also, though the Green Line is most proximate to Park Plaza, the three other lines also are expected to carry a large proportion of Park Plaza related trips.

The Green Line serves as both a high-density collector/distributor for downtown and a suburban line-haul facility. It currently operates with a scheduled peak period headway of 64 seconds in the central tunnel and train length of either 2 or 3 cars. A 1974 count at Arlington Station, at the line's most heavily used point, indicated an outbound P.M. peak hour line count of 8100 passengers and an inbound A.M. peak hour of 7300 passengers per hour per direction as the current scheduled capacity, based on a passenger loading of 90 passengers/car for the PCC cars. "Crush loading" can be as high as 120. Thus, the Green Line is operating at or near its capacity limit. The peak hour factor in the 1974 count was .218.

Current problems on the Green Line result from an insufficient fleet of cars, unreliable frequency of service, unreliability of the PCC cars, and long station dwell times caused by the number and poor location of the car doors. Because four Green Line surface routes converge in the central tunnel with no systematic scheduling, bunching of cars and poor schedule reliability occur. In contrast, the 1947 headways were from 36 to 40 seconds with one car trains and yielded a capacity of about 18,000 passengers per hour per direction at Arlington station. However, there were also more vehicles in service at that time and they were in considerably better running condition.

The Orange Line is a high-platform, rapid transit subway system with current northbound ridership of 10,400 passengers/hour/direction in the P.M. peak. The A.M. northbound peak volume is 9000 passengers/hour/direction.*

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* See footnote on the following page.

Scheduled capacity is 11,900 passengers/hour/direction and trains run approximately every 3.5 minutes with 4 cars. The scheduled capacity is based upon 175 passengers/car maximum, which gives each standee 2.0 square feet of floor space.

The Red Line capacity at Park Street, which is the closest Red Line station to the site, is 20,900 passengers/hour/direction in the peak with headways of 3.2 minutes. The Red Line cars carry an average of 275 passengers/car at 1.5 square feet per standee. The current P.M. northwest bound volume west of Park Street station is 9800 passengers/hour and the P.M. south bound at South Station is 14,000. The A.M. outbound count is 7900.* Four car trains are run during the peak.

The Blue Line has a current scheduled capacity of 10,000 passengers/hour/direction and runs on a 3 minute headway during the peak. Each car can carry 125 passengers at 2.25 square feet per standee and 4 car trains are run during the peak hour. The current inbound A.M. peak hour count is 8000 passengers and 8200 outbound for the P.M. peak.*

The M.B.T.A. 1974 map of station boardings is shown in Figure II-8. Park Street Station, handling both Green and Red Line passengers, has a count of 24,161 passengers per day, excluding transfers between the two lines. Essex Station on the Orange Line has a turnstyle count of 5834 passengers per day and Arlington Station on the Green Line has a two direction turnstyle count of 11,403 passengers per day. As a rough measure of current excess station capacity, Arlington Street handled 32,000 passengers per day in 1947 when maximum M.B.T.A. passenger counts were recorded.

E. Commuter Rail

Boston is served by two separate commuter rail systems, though both are now operated by the M.B.T.A. The Penn Central to the south and west operates 12 trains inbound in the morning and 11 outbound in the afternoon. Service is generally limited to 1 or 2 trains per line per period except for the Needham Heights branch which carries 3. A 1974-75 winter passenger count showed A.M. and P.M. riderships of 4530 and 3637 respectively, versus available seats of 4872 and 4304.

The Boston and Maine serves the northern and northwestern regions of the Boston area arriving and departing from North Station. Current Boston and Maine ridership is approximately 10,000 passengers per day. The 1972 Commuter Rail Improvement Program Report indicated a typical 1972 weekday

* Orange Line traffic is based on a 1965 M.B.T.A. characteristic count taken at Essex Street. Red Line traffic is based on a 1965 M.B.T.A. characteristic count taken at Park Street. Blue Line traffic is based on a 1965 M.B.T.A. characteristic count taken at Aquarium. Each count has been factored down by 6% to account for declining ridership. Capacities are based on data contained in Volume One of the M.B.T.A.'s Central Area Systems Study.

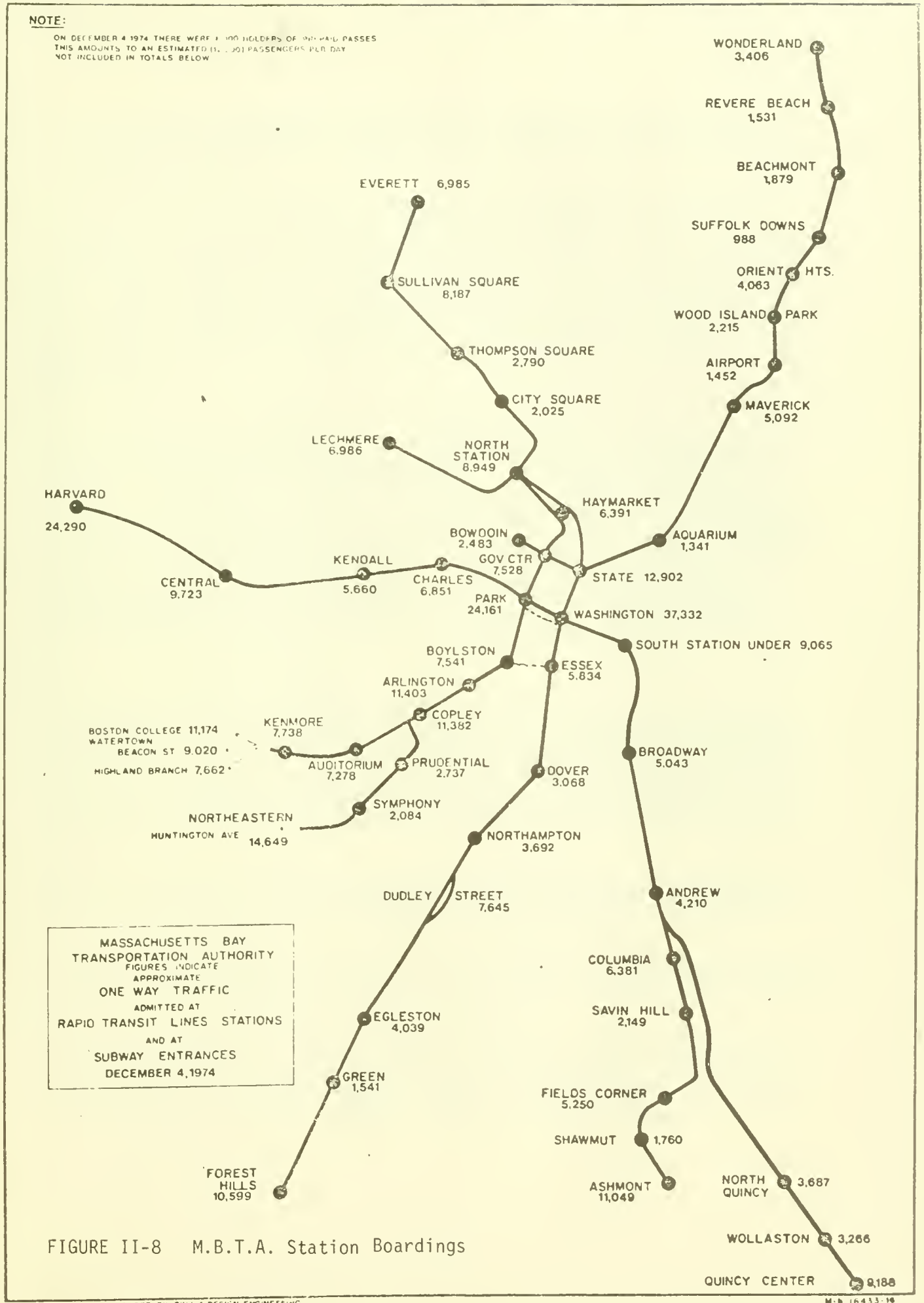

FIGURE II-8 M.B.T.A. Station Boardings

7:30 - 9:00 A.M. ridership of approximately 9800 with a range of 60 to 106 percent of the seats occupied. The average occupancy of the four main lines was 78%.

1972 total yearly passengers for the Boston and Maine were 5,413,735 compared to the Penn Central's 1,950,000 (estimate). The Penn Central serves both South Station and Back Bay Station, and it is felt that most Park Plaza related commuter rail passengers will choose to use the Back Bay location because it is closer to the site than is South Station. A 1974 count indicated that 34.5% of Penn Central riders utilized the Back Bay Station rather than South Station. The range on all branches except Needham was 27-33%; in contrast, 44% of the Needham passengers chose Back Bay Station.

The problems of the commuter rail system are basically the same as those facing most public transportation services, declining ridership in the face of rapidly rising costs. For example, Penn Central gross annual costs will rise from $2,330,602 in 1966 to an estimated $6,230,000 in 1975. In the same time, annual ridership will change from 2,480,824 to 2,407,116 and net annual costs will rise from $1,265,125 to an estimated $4,030,000. The estimated per ride deficit therefore is estimated to rise to $1.67. The two major questions with respect to commuter rail service are (1) will the commuter rail improvement program succeed in increasing ridership, and (2) will the Commonwealth and local communities continue to be willing to underwrite the annual deficits?

F. Local and Commuter Bus

Five bus operators, in addition to the M.B.T.A., currently use Park Square as the base of their inter-city and suburban bus operations. These are Continental Trailways, Peter Pan, Gray Line, Almeida, and Trombley. The majority of these services utilize the yard at the Continental Trailways station but because of inadequate bus parking space, many buses board and unload from illegal on-street parking spaces in the Park Square area on Eliot and Charles Streets.

The M.B.T.A number 700 express from Lowell also operates from Park Square as do two local bus routes. These are number 43 arriving from Tremont Street and number 691 running on Columbus and St. James.

Table II-1 summarizes bus movement data avilable from the B.R.A. There are a total of approximately 91 inter-city or commuter bus arrivals and departures, carrying approximately 4900 passengers.

These bus operations add significantly to existing traffic congestion in the Park Square area and on surrounding streets. Many of the buses currently use either Columbus Avenue or Stuart - Kneeland Streets as their principal route of access or egress. The scheduled movement of these bus

TABLE II-1

PASSENGER AND BUS DATA FOR TRAILWAYS STATION, PARK SQUARE

Bus Route or System	7-9 A.M.		4-6 P.M.		Remainder		Total Persons	
	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.
M.B.T.A. 700 Express	288	11	7	267	58	136	353	414
Grayline							2000*	
Almeida							For 35 buses 1100	
Trombley							470	566
Trailways**	4	6	3	9	28	29	35	44
Peter Pan**			1	1	4	6	5	7

* estimate

** bus arrivals and departures

operations and the Trailways terminal to the new South Station Transportation Terminal should alleviate this cause of local congestion, as well as remove the large share of existing pedestrian traffic related to the bus terminal.

G. Parking

Major supplies of both off-street and on-street parking are available in the Park Square area. Parking data were obtained from the various surveys collected in association with the recently completed Wilbur Smith and Associates report "An Access Oriented Parking Strategy for the Boston Metropolitan Area" (1974), and also from the City of Boston Department of Traffic and Parking.

Within the Park Plaza site area itself, there are presently two large, older garage facilities; the Motor Mart Garage with a capacity of 900 vehicles and the Eliot Street Garage with a capacity of 500 vehicles. In addition, there are four smaller open lots having a total capacity of 274 cars. These six facilities are scheduled to be replaced with a single new garage varying in size from 1395 to 3131 vehicles depending on the specific alternative.

The Wilbur Smith and Associates study showed a variation in the average walking distance from 170 feet for private garages to 1,745 feet for public garages. For purposes of this analysis, a figure of 1320 feet (1/4 mile) from the Park Plaza site area has been used as the limit of the parking inventory. Within this envelope, there are presently 39 lots and garages with a total of 6877 spaces.* The distribution of size of these facilities is as shown in Figure II-9. The 10:00 A.M. occupancy based on a 86% sample is 67%. Thus, approximately 2300 spaces are currently available at 10:00 A.M. within one quarter mile of Park Plaza. Since most employees have already arrived at work by this time, this figure indicates roughly the amount of parking presently available to shoppers and other visitors.

One reason for the low occupancy in these facilities is the desire, particularly for short term visitors, to park in low-cost on-street spaces. Presently there are approximately 1500 legal on-street parking spaces in the quarter mile area surrounding the Park Plaza site, based on a 1968 B.R.A. survey. This number will fluctuate slightly from day to day for street cleaning, and from hour to hour for peak hour parking bans. The average on-street turnover for the downtown area is 3.3 parkers per space, and the spaces are usually always occupied during the day. The inclusion of illegal on-street parking, which is heavily utilized in the area as in other parts of Boston, would further increase the inventory of available parking.

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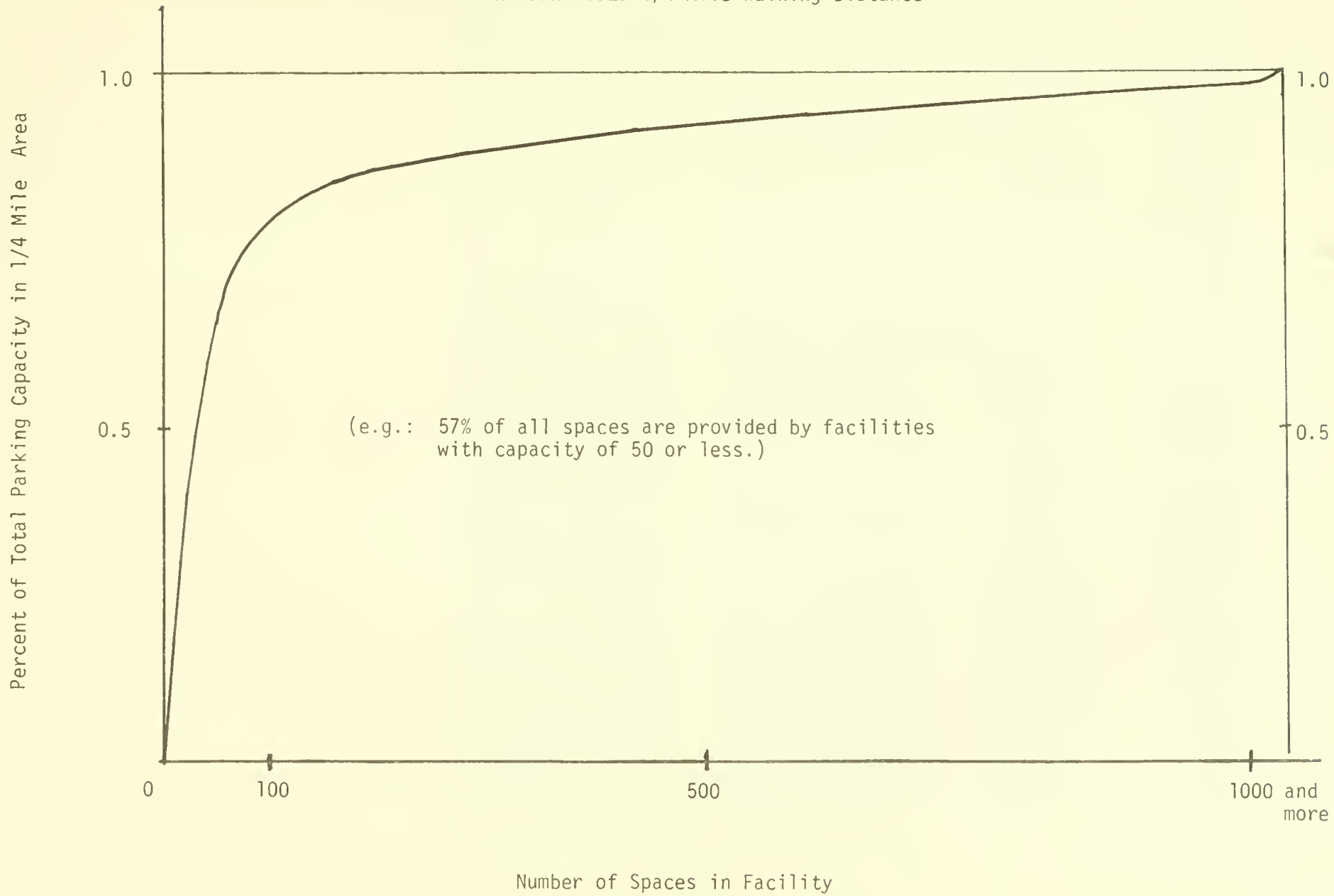
* These figures exclude the six on-site facilities.

Cumulative Capacity vs Parking Facility Size

within Park Plaza 1/4 Mile Walking Distance



A major parking problem occurs in the evening and at night in the neighboring residential areas of Bay Village and Back Bay. Both areas currently experience a severe on-street space shortage and residents find it especially difficult to locate space in the evening.

H. Pedestrian Movement

The major direction of pedestrian movement in the Park Square area is east-west, with the Trailways Bus Terminal serving as a large attractor within the site area itself. Other large pedestrian movements are oriented toward the Arlington and Boylston M.B.T.A. stations and also in a north-south, cross-site direction between the Bay Village area and the Public Garden and Boston Common.

Table II-2 shows existing hourly two-way pedestrian movements along selected streets in the Park Plaza area, based on a 1971 B.R.A. survey. The P.M. flows, even excluding the bus terminal movements, are considerably higher than the corresponding morning counts. The largest pedestrian volumes are shown as occurring on Boylston Street between Charles and Tremont, on Eliot Street near Tremont, and on Providence Street. To place these volumes in perspective, they represent less than one-quarter of the pedestrian volume levels observed along Washington Street and on Tremont street near Park Street, two of the more heavily walked streets in the core area.

Potential areas of conflict between vehicular traffic and pedestrian movement which may occur after Park Plaza is opened to occupancy are the same as those that exist now. These are the crossings of Charles Street at Boylston Street, Stuart Street, and within the site area itself, and the Charles Street and Tremont Street crossings of Boylston Street. The Charles Street crossing will handle persons bound for the Boston Common Garage, Beacon Hill, and also across Boston Common to Park Street and Government Center. The Boylston Street crossing is necessary to gain access to the M.B.T.A. Green Line Boylston station and may be used for other trips to and from the core area of downtown Boston.

TABLE II-2

EXISTING PEDESTRIAN MOVEMENTS

Location	A.M.	P.M.*
Public Garden (Boylston)	390	397
Boylston Street		
Public Garden		776
Boston Common		1640
Providence Street		1200
Eliot Street	396	596
Stuart Street	255	1080
Boston Common (diagonal)	378	1215
Church Street		476
Charles Street		592
Carver Street		92

* Excludes bus terminal movements

Source: B.R.A. 1971 pedestrian traffic count

III. 1985 BASE IMPACT AREA CONDITIONS

A. Time Schedule for Park Plaza Development

Park Plaza is scheduled to be developed in stages starting with the Park Square parcel and then extending to the Statler Hilton Parcel and to the Eliot Street Garage Parcel. Each stage would be separated by about three years, so that acquisition of major parcels would occur, as now scheduled, in 1975-76, 1978 and 1981-82. Initial occupancy is scheduled to occur in 1981 with subsequent major occupancy milestones occurring in 1985 and 1987.

The proposed Park Plaza parking facility is centered around a major rehabilitation of the existing Motor Mart Garage, but is also scheduled to be developed in stages since major parking expansion would be involved for each of the larger alternatives. The staged opening of the parking facility is shown in Table III-1.

The proposed staged development has two major implications for the transportation analysis. The most important is that the 1975 existing conditions described in the previous chapter must be forecast to one or more future years so that the impact of projected Park Plaza trips occurring in those years can be estimated. As an approximation, 1985 has been selected as the single base year, and remaining sections of this chapter discuss the factors necessary to forecast 1985 base transportation conditions; specifically:

- Historical trends in modal utilization
- Committed transportation improvements
- Population and employment projections
- Other planned office and retail developments
- Existing trips to be displaced by Park Plaza
- Existing travel patterns of projected Park Plaza population

Specific conclusions for each of these factors are summarized in Section G, after each topic has been separately discussed.

The second implication of the development schedule is that the staged opening of Park Plaza to tenants will itself act to mitigate potentially adverse transportation impacts in comparison to opening of the development for total occupancy at a single point in time. People's transportation behavior has been shown to be quite adaptable; individuals change their choice of travel time, mode, and routing as the level of service changes. Similarly, the transportation system itself changes, making accommodations through new traffic signal timings or changes in train service frequencies in order to handle a higher demand. When these changes occur in relatively small increments

TABLE III-1

Time Schedule of Park Plaza Parking Availability

Time	Alternative				
	2M	3M	4M	5M	6M
1978	930	930	930	1200	1482
1979					
1980					
1981					
1982	465	465	645		
1983					
1984					
1985				860	1649
Total Spaces	1395	1395	1575	2060	3131

and are staged over a period of 6-10 years, the effect is to significantly diminish the effect of what would appear to be a potentially large number of new trips were they all to be added to the system at a single point in time.

B. Historical Trends in Modal Utilization

One means of forecasting 1985 modal usage is simply to examine recent changes in travel and to extend these trends to the desired future year based on either a linear or a more elaborate extrapolation scheme. The examination of historical trends can also serve as a check on the realism of any separate modal forecasts that may be available. However, because of possible changes in transportation policy or the rate of new construction, care should be taken not to rely exclusively on historical traffic trends.

Changes in automobile traffic levels over time have been determined by examining cordon counts published by the city of Boston Traffic and Parking Department. Figure III-1 illustrates changes in daily and peak hour counts from 1954 through 1974. As can be seen, both the A.M. and P.M. peak counts remained stable between 1964 and 1972, but increased from 1972 to 1974. For example the P.M. peak hour vehicle flows leaving the cordon area were as follows:

	Vehicles	% Increase
1964	20,000	
1972	20,100	.5%
1974	22,100	10%

These numbers include both expressways and arterials. Examination of arterials, however, yields a different set of figures, as shown in Figures III-2 and III-3, and tabulated below:

	4-6 P.M.			% Change	
	1954	1972	1974	54-72	72-74
Commonwealth Ave.	2209	1694	1784	-23%	5%
Columbus Ave.	1698	1604	1687	-5.5%	5%

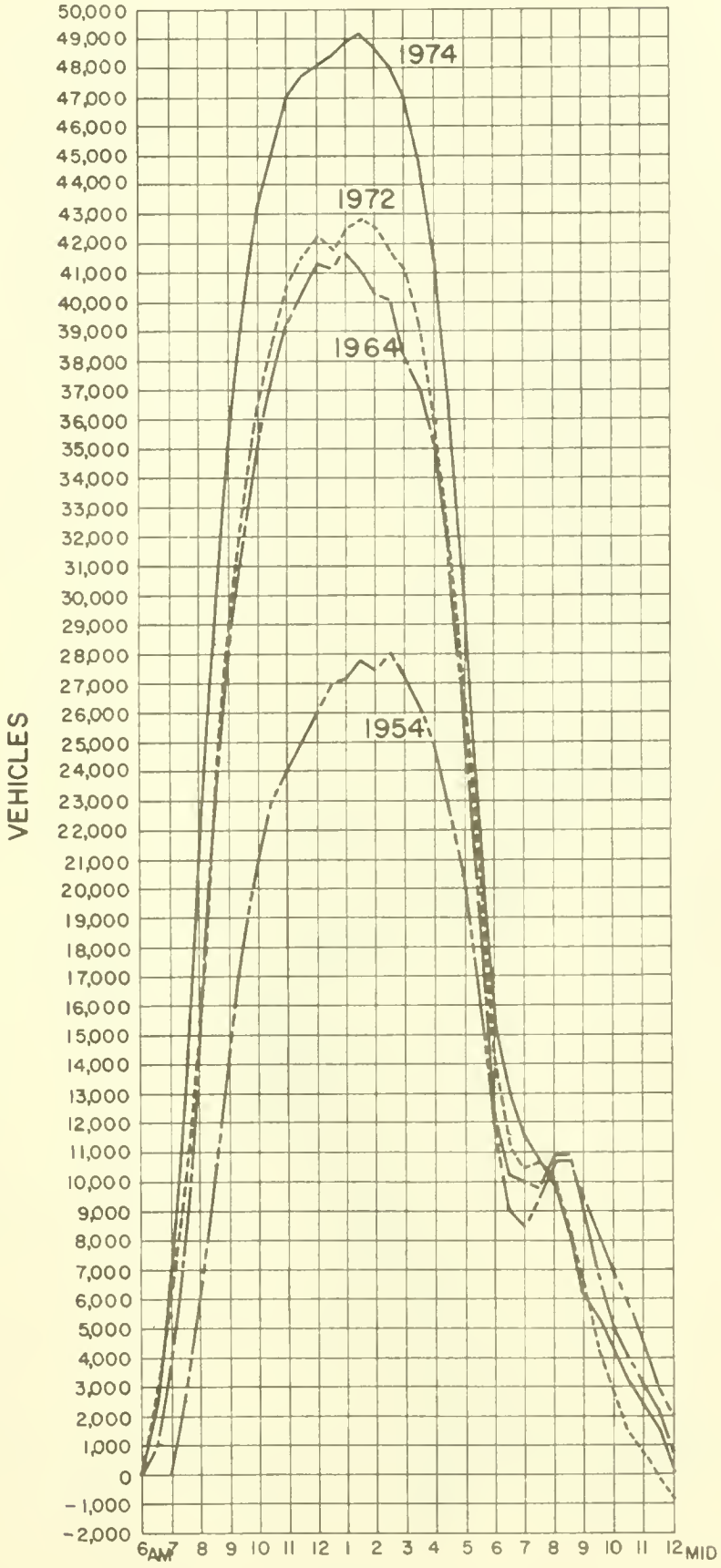
Traffic on Commonwealth Ave. decreased 23% between 1954 and 1972 with the opening of the Massachusetts Turnpike extension. Between 1972 and 1974, traffic has increased, but less rapidly than the total cordon count. The Columbus Ave. figures are similar but not as dramatic since the southwest corridor is not directly served by an expressway. These numbers seem to indicate that recent traffic growth can be explained and characterized by an increasing reliance on the use of expressways for major access. It should be noted, however, that these counts are taken at the downtown cordon line and undoubtedly differ in their trends

FIGURE III-1

COMPARISION 1954, 1964, 1972, & 1974

ACCUMULATION OF VEHICLES ENTERING & LEAVING STUDY AREA

6:00AM TO 12:00MID



Source: Cordon Count, Downtown Boston, 1974, Boston Traffic and Parking Department

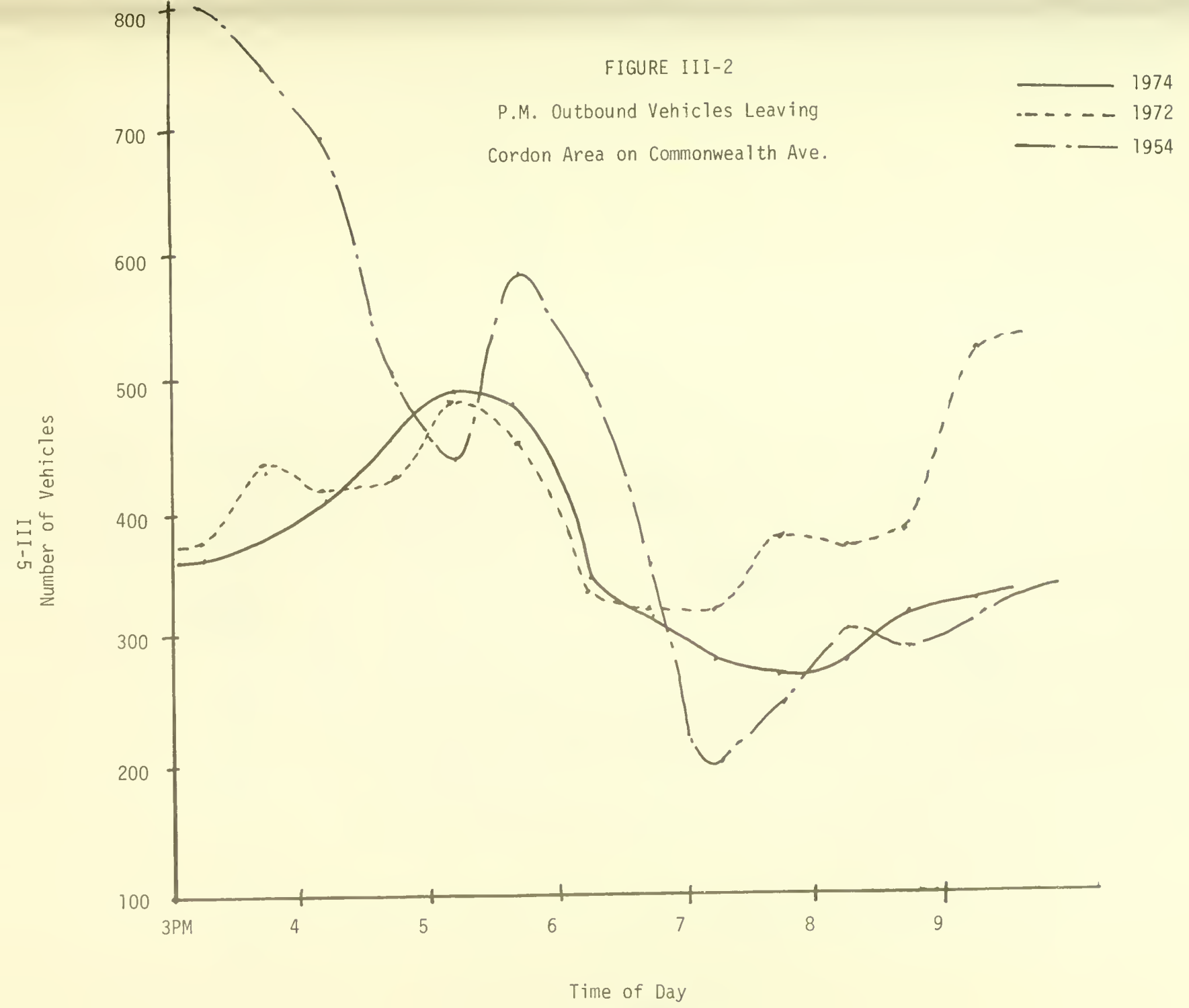


FIGURE III-2
P.M. Outbound Vehicles Leaving
Cordon Area on Commonwealth Ave.
1974
1972
1954
800
700
600
500
400
300
200
100
3PM
4
5
6
7
8
9
Number of Vehicles
Time of Day

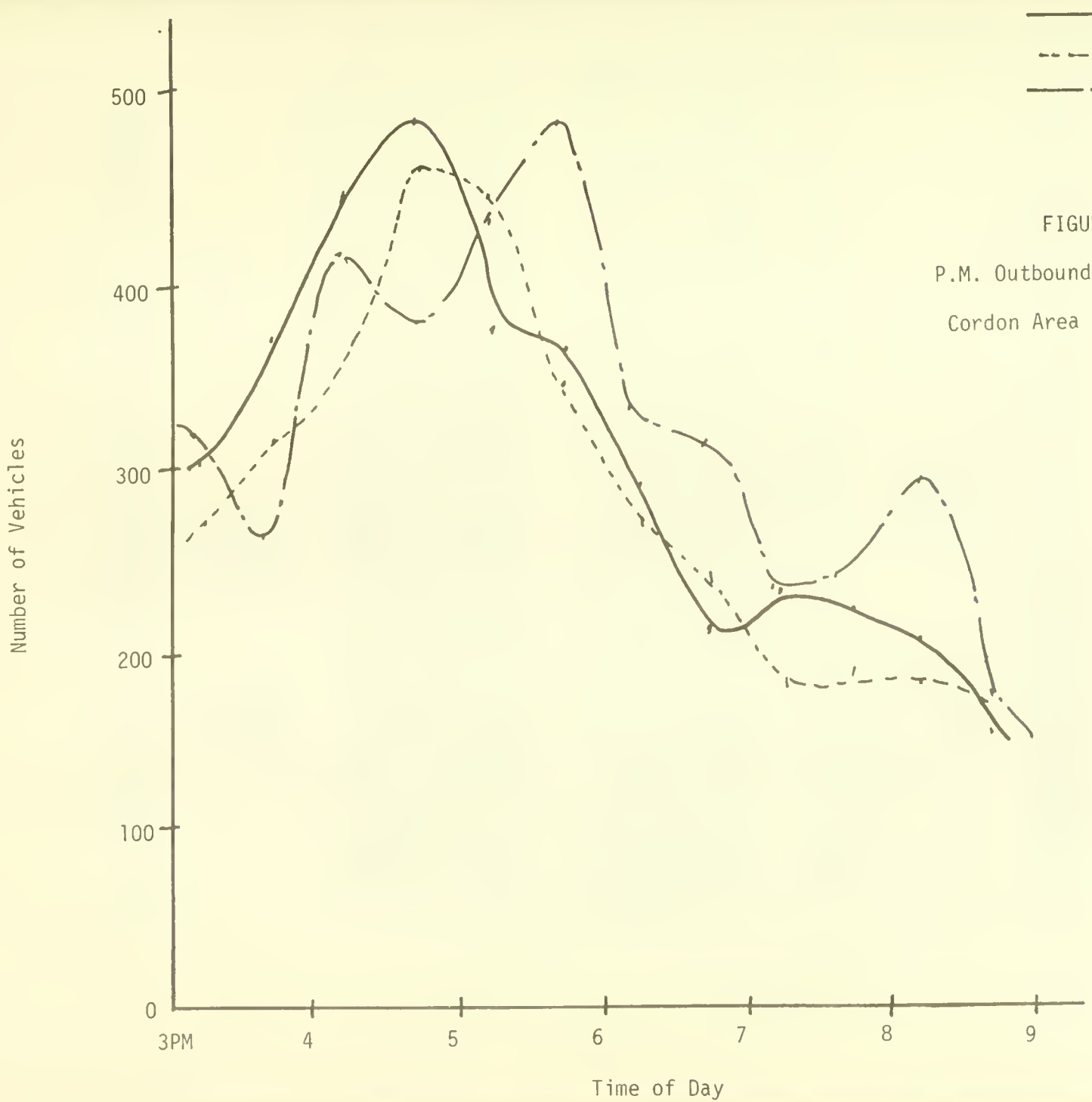


FIGURE III-3

P.M. Outbound Vehicles Leaving

Cordon Area via Columbus Ave.

from those of local arterials and streets in the immediate Park Plaza area. Streets within the core area serve as collectors and distributors for all C.B.D. oriented vehicles, regardless of their means of access. Their rate of change in traffic flow can be expected to be somewhere within the range defined by the total cordon count and the major access arterials.

The vehicle cordon count data also can be examined to get an idea of changes in peak parking demand. The following represent changes over time of maximum vehicle accumulation (Figure III-1).

	Vehicles	% Change	
1964	41,600		
1972	42,900	3%	
1974	49,100	14%	18%
		('72-'74)	('64-'74)

These numbers again show a relatively stable condition between 1964 and 1972, with a rapid increase between 1972 and 1974.

Changes in transit ridership can be determined by examination of both the downtown cordon line counts and the published M.B.T.A. station boardings. Table III-2 summarizes selected cordon count information. All forms of rapid transit have suffered from a decreasing utilization. The larger peak losses result in part from changes in travel patterns. For example, the 4:00-5:00 streetcar count of persons leaving the study area increased 23% between 1972 and 1974 while the 5:00-6:00 decreased 35%.

These same trends are confirmed by the station boarding counts. Daily station boardings declined from 441,900 in 1964 to 378,955 in 1974, a decrease of 14%. Table III-3 illustrates station boardings over time for selected rail transit stations in the vicinity of Park Plaza. Copley and Boylston on the Green line have experienced growth while only Charles St. on the Red and Orange lines have grown. A pattern of stable to decreasing ridership was predicted in 1969 by the Central Area Systems Study. The following numbers represent 24 hour, weekday directional volumes between Arlington and Boylston stations, as forecasted by this study:

	Inbound	Outbound
1964 calibration	50,716	53,013
1975 low	49,938	52,728
1975 high	55,122	57,912

Commuter rail systems serving the Boston area have experienced a similar decline in ridership, showing estimated annual losses between 1966 and 1973 of approximately 3% and 1% on the Boston and Maine and

TABLE III-2

P.M. Peak Public Transportation Ridership Counts

System	4:30 - 6:00 P.M.			% Change	
	1964	1972	1974	64-72	72-74
Streetcars	14829	14117	10849	-5%	-23%
Rapid Transit	67507	59039	50906	-13%	-14%
Buses	7224	8306	8727	15%	5%

System	Total Daily			% Change	
	1964	1972	1974	64-72	72-74
Streetcars	52279	50832	43157	-3%	-15%
Rapid Transit	166906	158761	144316	-5%	-10%
Buses	32667	24647	26870	-25%	+10%

TABLE III-3

2 Way Station Volumes Near Park Plaza 24 Hr.

DATE *	STATION							
	Green			Red		Orange		
	Copley	Arlington	Boylston	Park	Charles	Wash.	Essex	State
1964	11600	15200	6800	28700	3450	45900	9200	16100
1970	10490	17493	6411	30218	6153	45032	6265	14220
1971	9189	16415	7816	30495	6229	47520	6262	14002
1972	11191	16559	6117	25107	6348	40500	6429	15644
1973	11552	14513	5425	26039	6390	38057	6452	14197
1974	11382	11403	7541	24161	6851	37332	5834	12902
5 Yr. % Change (70-74)	+ 9%	-3%	+18%	-20%	+11%	-17%	-7%	-9%

* December 4, 5, or 6

Penn Central systems respectively (Table III-4). Between 1972 and 1973, B & M ridership actually declined 6.4%.

C. Committed Transportation Improvements*

A number of major improvements to the transportation system serving the Park Square area are scheduled for implementation before 1985, and are described in the following paragraphs. As these new or improved facilities will be in place prior to Park Plaza occupancy, they will serve to change, rather significantly in some cases, the capacity and characteristics of the transportation system available to serve Park Plaza. The analyses and findings described in Chapter V assume the described improvements will be implemented and operational. In several cases, such as the local street system, still further improvements are possible; these are discussed separately in Chapter VII as mitigating measures.

Some of the changes are being planned independently of Park Plaza, while others such as new Charles St. will be developed in conjunction with Park Plaza. Both types of changes are described below.

Streets

Inherent in the Park Plaza plan is removal of Park Square, removal of Columbus Ave. between Arlington St. and the Square, construction of new Charles St., and improvements to Stuart/Eliot St.

New Charles St.: Charles St. will be continued between Stuart and Boylston with a 52' right-of-way. The street will be one-way northbound with 4 lanes and 1 loading lane.

Stuart St.: Stuart St. will be widened to provide 6 moving lanes from the site to east of Washington St. This will increase capacity considerably to both the Southeast Expressway and I-93 from Park Plaza. Current problems contributing to congestion will be eliminated such as narrowness, poor alignment, and lack of lane demarcation.

Tremont Street Widening: On the north side of Boylston, a widening of Tremont Street to accommodate right-turns onto Boylston is being considered. As part of the Park Plaza Project, a widening is planned between Allen's Alley (south of Boylston)and Stuart Street.

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*Information presented in this section is based on material furnished by the Boston Redevelopment Authority and also on conversations with officials of the M.B.T.A. and the Executive Office of Transportation and Construction.

TABLE III-4

Commuter Rail Annual Passengers

	1966	1973	% Change
Boston and Maine	6,390,263	5,062,346	-21%
Penn Central	2,215,321	2,103,300*	- 5%

* Estimate, last count was 1971, 1,979,919

Source: Massachusetts Bay Transportation Authority

Several other possible street improvements could affect Park Plaza related travel. These include the following:

New Essex Street: Creation of new 3-lane westbound street on Essex Street, Rowe Place, Exeter Place and Avery Street between Atlantic Avenue and Washington Street; thereby improving east-west circulation through downtown and possibly taking traffic off Stuart-Kneeland Streets.

Tremont Street/Columbus Avenue: As part of the South End Urban Renewal Plan, Tremont Street and Columbus Avenue are currently being redesigned. Columbus Avenue will provide a 44' roadway, with two moving lanes and two parking lanes. Parking will be prohibited in the peak direction in peak hour, to provide three moving lanes. Tremont Street will provide a 44' roadway plus two 8' parking lanes to be defined by neckdowns. The redesign is intended to accommodate existing volumes; however, Columbus Avenue will be turned into Tremont at Sarsfield Street, thus encouraging use of Tremont for through-traffic, and thereby affecting approaches to Park Plaza.

Massachusetts Turnpike Ramps: Land in the vicinity of Atlantic Avenue and South Street formerly used for rail service is being considered for additional Turnpike ramps. A new northbound ramp would be constructed to feed traffic to Atlantic Avenue with the South Street ramps becoming one-way southbound. A direct connection would be provided to the new South Station Garage. The most immediate impact of this change would be to lessen the current confusion at the intersection of Kneeland Street and the Central Artery; the project also would have a major effect on Stuart-Kneeland traffic and on the Park Plaza area by providing easier east-west access to the Turnpike.

An additional change to the local street system which could affect Park Plaza is the proposal currently under consideration to narrow Boylston St. between Arlington and Charles Streets. Presently there are six lanes of moving traffic and two lanes of parking. Two specific proposals are being considered: 1) return some of the northern lanes to the Public Garden, and 2) reclaim some of the southern lanes for pedestrian frontage to Park Plaza. Assuming that the new Park Plaza parking garage entrances will be located on Stuart Street, little new traffic is expected to use the Boylston frontage, especially since new Charles Street will flow one-way away from the site. Our analysis indicates excess capacity on this part of Boylston Street, even with projected Park Plaza trips. At least two and possibly three lanes of Boylston St. could be returned to non-traffic use without creating serious adverse effects.

Rapid Transit

M.B.T.A. Green Line: A major improvement program is presently underway to upgrade service and capacity in the Green line central subway system. This long-term upgrading program is designed to eliminate the specific problems discussed in Chapter II regarding:

- insufficient number of vehicles;
- poor vehicle reliability;
- long station dwell times due to insufficient number of vehicle doors;
- unreliable scheduling of vehicles due to "bunching", interference with local street traffic, poor track signalization, and junction operation.

The first of the improvements is scheduled for late Fall, 1975. 175 new light-rail transit vehicles will replace most of the existing PCC cars, and additional power substations will provide electricity to handle increased acceleration, speed and air-conditioning. The car improvement is expected to increase one-way capacities to 16,000 passengers per hour at 68 second headways in the central subway. In contrast, current one-way peak hour volumes at Arlington Street are in the range of 8100 passengers, and the six million sq. ft. Park Plaza alternative is expected to increase ridership on the eastbound portion by 1800 passengers in the P.M. peak.

Each of the new vehicles has a maximum passenger load of 220 compared to 142 on the present PCC cars. The articulated cars are 70 feet long, 50% longer than the current cars, and 8 feet wide. Also, the new cars will have three doors on each side, while the PCC's have two doors on the right and one on the left. Each car will be equipped with two-way radio to improve dispatching.

M.B.T.A. Orange Line: The Orange line is being relocated from its present alignment along Washington Street to the mainline Penn Central rail tracks in the southwest corridor. While the final design is not yet complete, the South Cove tunnel portion and station is already partially constructed. Thus, Park Plaza will be served by both the new South Cove and Back Bay stations in addition to the existing Essex St. Station. Construction for the entire relocation is scheduled to be completed by 1985. It is generally agreed by transportation professionals that the new Orange line will attract riders from the Green line, accommodating both line haul and downtown distribution needs.

Commuter Rail

A major Commuter Rail Improvement Program (CRIP) of approximately $75 million is planned for the 1977-1980 period which would improve capacity

and operations of Penn Central trains serving the Park Plaza area via Back Bay Station. The initial program includes acquisition of new cars, modernization of existing cars, new roadbed, and station improvements. A second phase includes electrification in order to achieve compatibility with the future inter-city rail system.

Commuter and Inter-City Bus

The Continental Trailways bus terminal now located in Park Square will be relocated to the new South Station Transportation Terminal, thereby eliminating the existing congestion of intercity and suburban express buses. Presently buses park illegally around Park Square, Eliot Street, and Charles Street. Many of the 91 scheduled buses use Columbus Avenue for access to the Massachusetts Turnpike or use Stuart-Kneeland Streets for access to the Central Artery. The current pedestrian movements and vehicle flows in the Park Square area associated with these arrivals and departures would be eliminated.

Parking Garages

Two new parking facilities could attract some Park Plaza bound trips. The 1500-car South Station garage, estimated to be completed in 1980, could serve some daytime parkers because of its convenience to the expressway. The 2000-car garage being developed as part of the LaFayette Place is not expected to serve Park Plaza during the day time but could compete for entertainment-related parking during the evening.

Pedestrian Movement

Plans for new and improved pedestrian circulation are described in the January 9, 1975 memorandum from Stewart Forbes, B.R.A., to the Park Plaza Civic Advisory Committee. While the specific details of pedestrian movement must await final design, the intent is to provide improved at-grade, north/south connections through the site area. Under consideration are 1) a pedestrian route aligned with Church Street connecting Bay Village and the Public Garden,and 2) a pedestrian route aligned with Warrenton Street connecting the legitimate theaters with Boylston Street and the Boston Common Parking Garage. These new north-south facilities are in addition to committed pedestrian connections along new Charles Street, improved east-west pedestrian movement along both Boylston and Stuart Streets, and a possible graded pedestrian crossing over new Charles Street.

D. Population and Employment Trends

In estimating 1985 base year conditions, it is important to look at recent and projected changes in both the resident population and the employment contained in downtown Boston. Future traffic conditions,

especially during the peak commuting hours, can be expected to be directly related to these two variables. A large increase in downtown employment, especially of middle to upper income service jobs, might be expected to result in a growth of automobile traffic. This growth, however, could be offset somewhat by a parallel growth in downtown population.

Information presented in this section is based on data prepared by the Boston Redevelopment Authority. Their sources were the 1970 U.S. Census, the 1974 Wilbur Smith Associates "Parking Strategy for Boston", and work by their own Research Department.

While the Boston Transportation Planning Review identified the portion of Boston between Routes 128 and 495 as constituting the area of highest population and employment growth, they also concluded that the core of Boston was likely to retain its population and to experience some slight growth in jobs. With public assistance, increased growth in the core city could be expected.

The information presented in Table III-5 is consistent with this general projection. Based on these figures, the B.R.A. estimates a 1970 to 1985 growth of 93,720 or 23% in the accumulated daily population of downtown Boston and of 74,664 or 21% in the total trips in the downtown area. The lower rate of increase in trips relative to employment growth reflects the large increase in downtown residents. The B.R.A. estimates based on current surveys that 63% of these residents will be employed, and that 50% of those employed will work downtown.

The specific new developments on which the floor space projections in Table III-5 are based are listed in Table III-6. These are major projects either planned or underway and scheduled to be completed by 1985. Of those identified, the 2,000,000 sq. ft. Hancock office tower is the most proximate to Park Plaza, being located in the block bounded by Clarendon St., Stuart St., Trinity Place, and St. James Ave. just off Copley Square. While the projected Hancock employment and trips are included in the figures of Table III-5, it is likely that many of the autos visiting Hancock, at least in part, will use the same routings as will Park Plaza bound traffic. The normal inbound peak hour automobile volume to the Hancock Tower is anticipated to be 1000 vehicles.* Also, the Hancock Tower and Park Plaza are located on the Green line so this transit facility will be affected by both developments.

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* Barton-Aschman Associates, May 1969.

TABLE III-5

Downtown Boston Population and Employment Trends

	Year				% Change		
	1960	1970	1975	Estimated 1985	60-70	70-75	70-85 75-85
Population	33,779	36,738		55,794	9%		52%
Employment		242,000	272,000	329,000		12%	36% 21%

Floor Space

	Year		
	1975	1985	% Change
Office (sq. ft.)	28,500,000	38,000,000	33%
Retail (sq. ft.)	5,900,000	7,300,000	28%
Hotel (units)	7,151	10,151	56%

Source: Boston Redevelopment Authority

TABLE III-6

Inventory of New Development

Underway or Planned to be completed by 1985)

Project	Gross Additional Office (sq.ft.)	Retail (sq.ft.)	Hotel (units)	Housing (units)	
D, West End, Waterfront					
ue Cross/Blue Shield	1,100,000	5,000			
deral Reserve Bank	950,000				
tional Shawmut	1,150,000	10,000			
ate Office Bld. II	650,000				
incy Markets	175,000	200,000			
State Street	750,000	5,000			
5 Federal Street	150,000				
arlestown Savings Bank	130,000				
Winthrop Square		18,000			
fayette Place	1,200,000	610,000	750		
auncy House				87	
d South Square	130,000	26,000		400	
anford Blg.	200,000	11,000			
y. Lowell-Eld.				150	
arles River Park D				710	
ackstone-Eld.				280	
her-Waterfront				800	(approx. including C-2, Sargent Wharf
SUBTOTAL	6,585,000	885,000	750	2,427	other proposed)
ck Bay, Beacon Hill, South Cove					
eraton			430		
ncock Tower	2,000,000				
5 Boylston	91,000				
ndome Conversion				120	
liday Inn-Dalton			430		
atler	(200,000)		700		
ylston -Exeter		12,000		160	
wdoin				30	
CDC (P4-A)				65	
uth Cove-					
7, R-4				380	
1 Nursing				120	
inese Ch. Life Ct.				120	
SUBTOTAL	1,891,000	12,000	1,560	875	
tal Underway or Planned	8,476,000	897,000	2,310	3,302	
ditional Projected, ark Plaza or other)	1,024,000	523,000	1,690	2,698	
TOTAL	9,500,000	1,400,000	4,000	6,000	

Source: Boston Redevelopment Authority

E. Existing Trips to Be Dislocated By Park Plaza

The Park Plaza site area presently contains both retail and office space, in addition to the parking facilities and bus terminal. These activities presently generate trips, some or all of which will be displaced by Park Plaza. These activities may relocate to other areas of Boston, move into Park Plaza, or cease altogether. In any case, the associated trips represent travel that exists now but which will not exist after Park Plaza is constructed. As such, these trips should be subtracted from either the 1985 base conditions or the projected Park Plaza trips.

Table III-7 shows existing, displaced, and new employment and floor space figures for two activity types: retail and office. The figures indicate that for the 3 million alternative, 43% of the existing retail floor space will be displaced and that the displaced floor space represents 46% of the planned new retail floor space. The corresponding figures for office employees are 60% and 17%. Assuming an equivalent trip making propensity (which may be more valid for office employees than for retail given the current mix of retail activities), these figures imply that the projected Park Plaza retail and office employee trips might be reduced by as much as 46% and 17% respectively in order to determine the transportation impacts. For the six million figure, the similar figures are 61% and 8%.

It is not proposed that figures of this high a magnitude by used in the analysis since the trip generation rates of the existing activities are both lower and of a different time distribution than those projected for Park Plaza. However, for A.M. and P.M. peak hour trip making which is largely employee oriented, a figure in the 10% range may be reasonable depending on the specific alternative being examined.

F. Existing Travel Patterns of Projected Park Plaza Population

The population of Park Plaza can be characterized as being either new to Boston or relocated from a site already in Boston. Those persons being relocated to Park Plaza are already using the regions transportation system. Accordingly, they do not represent entirely new trips, although they clearly may be new trips to the streets, rapid transit lines, and stations serving Park Plaza.

A source of information on this issue is a B.R.A. Research Department report, "Prudential Center, Part I: Its Direct Impact on Boston." The purpose of the study was to classify firms according to whether or not they increased employment in the city of Boston. Those increasing employment were newly created firms, new branches or chains, or firms new to Boston. The remainder were firms moving from previous locations in Boston. Table III-8 presents the results of this survey, indicating

TABLE III-7

Existing Trips To Be Displaced By Park Plaza

	Existing	Displaced					New				
		6M	5M	4M	3M	2M	6M	5M	4M	3M	2M
Retail											
Sq. Ft.	216400	216400	183231	153225	92353	-	351965	320765	251415	199050	48174
Employees	898	656	614	309	107	-	1477	1350	1058	836	198
Office											
Sq. Ft.	649260	649260	638204	449733	277021	-	1826969	1930185	1346591	530635	347338
Employees	618	618	618	381	370	-	7367	7758	4423	2229	1424

TABLE III-8

Prudential Center Effect on Employment

	No. of Firms	People Employed
Firms which increased Employment	54 (50%)	4106 (55%)
• Newly created firms	32 (29%)	131 (2%)
• New Branches of Chains	16 (15%)	3877 (52%)
• Firms new to Boston	6 (6%)	98 (1%)
Firms having no net Employment Effect	55 (50%)	3387 (45%)

Source: Boston Redevelopment Authority. "Prudential Center, Part I: Its Direct Impact on Boston."

that only 55% of the retail and office employment was new. The remaining 45% really reflect changes in current trips from their old site to the Prudential Center. As indicated above, a certain number of these already would be using the local streets and M.B.T.A., so that they really do not constitute new trips or a new demand for travel. Assuming similar patterns for Park Plaza, failure to take these trips into account could result in up to a 45% overestimate of Park Plaza transportation impacts, depending on the exact previous location of the trip destination. A figure of 10% is felt to represent a conservative allowance for this particular kind of relocation effect, and assumes most Park Plaza related trips will be new to the immediate area now constituting Park Square.

There also are second order effects that could be introduced. Those Boston firms moving to Park Plaza will vacate space which may be rented both by "new" firms and by existing firms, resulting in further, but indirect, transportation impacts. No allowance for such second order effects has been made as part of this study.

G. Treatment of 1985 Base Year Conditions

This chapter has discussed a number of factors necessary to project 1975 existing conditions to 1985 base year conditions. While a wide variety of numbers have been presented in order to communicate an understanding of the kinds of changes that may occur over the next ten years, the following conclusions are of primary importance.

- Several major improvements to the capacity and operation of both the street and transit systems serving Park Plaza will be implemented prior to occupancy. The most significant of these are the M.B.T.A. Green line where scheduled capacity will be approximately doubled and the local street circulation system in the immediate vicinity of Park Plaza where existing causes of congestion will be eliminated.

- Downtown employment may increase in the range of 15-20%.
- This employment increase, combined with the scheduled improvements to the rapid transit and commuter rail systems and the downtown parking policy, may be sufficient to stabilize and possibly even reverse the current downward ridership trends on the M.B.T.A.
- Automobile traffic on the local streets in the Park Plaza area is likely to continue to grow, though probably at a lower rate than in the 1972-74 period. A figure of 15% over the ten year period is felt to constitute a reasonable estimate.

- Park Plaza will displace some existing trips on all modes of travel, approximately 10% of the projected new trips.

- Up to 45% of the activities to be associated with Park Plaza will move from other areas within the Boston region. Consequently, some of these trips may not reflect new trips to the transportation system serving the immediate Park Plaza area. A reasonable allowance for this factor is felt to be 10% of projected new Park Plaza trips.

IV. PARK PLAZA GENERATED TRIPS

The Park Plaza development will generate or attract trips associated with its commercial offices, hotel, retail outlets, and residential living units. To forecast the transportation impacts of each of the Park Plaza alternatives, it is first necessary to estimate the following five kinds of information:

- Population characteristics of occupants and visitors for each alternative,
- Daily trips generated by each activity type,
- Distribution of these trips by time of day,
- Geographic distribution of the origins and destinations of these trips,
- Modal facilities most likely to be utilized for each type of trip.

This chapter summarizes the data which have been collected and analyzed in each of these areas. These numbers are then used as the basis for the traffic assignments and parking analyses developed in Chapter V.

A. Population Characteristics

The estimated daily user populations for each of the five basic Park Plaza alternatives are tabulated in Table IV-1. The population is categorized by office employees, business visitors, retail employees, shoppers, hotel employees, hotel visitors, and residents. The peak period for both shopping and hotel visits is the fall when 35% of the total estimated annual shopping visits and 36% of the total estimated annual hotel visits occur. It is the associated daily figures that are contained in Table IV-1 since the transportation analysis is oriented toward the peak or worst period.

For each activity type, the population is further divided into trips that originate from on-site, from within downtown Boston, and from outside the downtown area. Different transport modal split assumptions are used for each of these areas. Those office employees that also reside in Park Plaza apartments are assumed to walk to work and are excluded from the population totals.* The numbers in the right hand column then reflect total person trips coming to Park Plaza from somewhere within the Boston area. In the case of shopping trips, these numbers do not constitute individual store visitations. A single person coming from either downtown or outside downtown will likely visit multiple stores. Also, shopping visits exclude all shopping trips that originate from within Park Plaza itself; for example,

* No retail or hotel employees are assumed to live within the site area.

TABLE IV-1

Summary Table of Daily User Population

User	Origin			
	On Site	Downtown	Outside Downtown	Total
6 Million Alternative				
Office Employees	(168)	527	6840	7367*
Business Visitors	-	151	603	754
Retail Employees	-	30	1447	1477
Hotel Employees	-	14	680	694
Residents	2468	-	-	2468
Hotel (Fall, High Est.)	1573	-	-	1573
Shoppers (Fall)	-	4487	7404	11891
Total	4041*	5209	16974	26224
5 Million Alternative				
Office Employees	(158)	554	7204	7758*
Business Visitors	-	158	634	792
Retail Employees	-	27	1323	1350
Hotel Employees	-	14	680	694
Residents	1628	-	-	1628
Hotel (Fall, High Est.)	1573	-	-	1573
Shoppers (Fall)	-	4487	6955	11442
Total	3201*	5240	16796	25237
4 Million Alternative				
Office Employees	(90)	316	4107	4423*
Business Visitors	-	90	361	451
Retail Employees	-	21	1037	1058
Hotel Employees	-	14	680	694
Residents	1493	-	-	1493
Hotel (Fall, High Est.)	1573	-	-	1573
Shoppers (Fall)	-	3440	4801	8241
Total	3066*	3881	10986	17933

Summary Table of Daily User Population

User	Origin			
	On Site	Downtown	Outside Downtown	Total
3 Million Alternative				
Office Employees	(46)	159	2070	2229*
Business Visitors	-	46	182	228
Retail Employees	-	17	819	836
Hotel Employees	-	8	374	382
Residents	1125	-	-	1125
Hotel (Fall, High Est.)	787	-	-	787
Shoppers (Fall)	-	2917	4128	7045
Total	1912*	3147	7573	12632
2 Million Alternative				
Office Employees	(29)	101	1323	1424*
Business Visitors	-	29	116	145
Retail Employees	-	4	194	198
Hotel Employees	0	0	0	0
Residents	494	-	-	494
Hotel (Fall, High Est.)	0	0	0	0
Shoppers (Fall)	-	2000	0	2000
Total	494*	2134	1633	4261

* Excludes office employees who live in Park Plaza.

Source: B.R.A. Internal Memorandum, "Park Plaza Daily User Population", May, 1975.

a noon shopping trip by an office employee. All such trips are assumed to involve only walking. Other assumptions utilized in deriving these numbers are described in the cited B.R.A. source document.

For the purposes of this analysis, each member of a population type generally is assumed to make one trip arriving at and departing from Park Plaza. For example, an office employee arrives in the morning and departs in the afternoon. Since the worst traffic conditions will be the A.M. and P.M. peaks, it is reasonable to ignore any trips that may be made by auto or transit during the day. Similarly, each shopping visit is assumed to involve a single trip.* In contrast, most hotel visitors generate multiple trips in a single day.

B. Distribution of Trips by Time of Day

Trips by activity type are distributed over time with peaks occuring at different times for different types of trips. From Table IV-1, it is seen that office employees and shoppers constitute the two largest population groups. It is these two groups for which assumptions concerning times of arrival and departure are most critical. The assumed percentage of trips in the A.M. peak (8-9) and P.M. peak (5-6) are tabulated in Table IV-2. These assumptions are based on the results of previous B.R.A. surveys and reports, other portions of the Park Plaza Environmental Analysis, and Massachusetts Department of Public Works sponsored studies, and material published by the Transportation Research Board.**

The arrival times of parkers to the Boston Common Garage provides an indication of the arrival times of workers to this area of downtown Boston.*** It is assumed, conservatively, that 67% of the employees will arrive and depart during the respective peak hours. Business related visitors are assumed to arrive/depart throughout the day, with 10% falling in each peak hour. Because retail facilities open either after 9:00 A.M. or prior to the morning commute, the percent of retail employees arriving on site during the A.M. peak is assumed to be 20% of all retail employees. For the P.M. peak hour (5:00-6:00 P.M.), 40% of the retail employees are assumed to leave

*Several shoppers, however, may come in a single automobile. Assumptions of car occupancy are described later.

**One source summarizing previous studies of office buildings is "Urban Travel Patterns for Hospitals, Universities, Office Buildings, and Capitols", National Cooperative Highway Research Program Report 62, National Academy of Sciences, Washington, D.C., 1969.

***"An Access Oriented Parking Strategy for the Boston Metropolitan Area", Prepared for the Massachusetts Department of Public Works by Wilbur Smith and Associates, July 1974: Figure 47, pg. 167.

TABLE IV-2

Assumed Distribution of Daily Trips by A.M. and P.M. Peak

Activity	A.M., %	P.M., %
Office Employee	67	67
Business Visitors	10	10
Retail Employees	20	40
Hotel Employees	0	0
Residents	0	10
Hotel Visitors	10	25
Shoppers	7	20

the site. This number is higher than the A.M. peak because many retail facilities may close during the the 5:00-6:00 P.M. period. The remainder of the retail employees are assumed to be involved either with establishments having a later closing hour or in activities that would necessitate them leaving work either before 5:00 or after 6:00 P.M. For both peaks, it is assumed that hotel employees arrive and depart during off-peak periods thus contributing no peak hour trips. Hotel employee shift changes occur at times other than the A.M. and P.M. peaks in order to achieve a higher efficiency in serving hotel guests.

Shopping trip arrivals are estimated to be distributed over time as is shown in Table IV-3. For purposes of the transportation analysis, it is assumed that 7% of the arrivals to the site area will occur during the A.M. peak. For the P.M. peak, 20% of all shoppers are assumed to leave from Park Plaza.

The trip making patterns of Park Plaza residents generally will be the reverse of those working and shopping on the site. As indicated in Table IV-1, most Park Plaza residents who work are assumed to have the site for work elsewhere in Boston. Consequently, it is assumed that residents make no inbound A.M. peak trips. However,10% of the residents are assumed to make a P.M. outbound trip, e.g.,for dinner, shopping,etc. These P.M. outbound trips are assumed to be made half outisde and half inside downtown. Analysis of the reverse commuting patterns indicated that these trips would not add significantly to the transportation impacts of Park Plaza. In designing street access and traffic flow patterns to serve the peaking conditions, care must be taken not to impede or block these reverse flow trips.

For hotel guests, approximately 10% of the population are assumed to make a trip to the site in the A.M. peak, and 25% to make an outbound trip in the evening peak. The latter figure is higher than the former because some hotel guests beginning trips for dinner, entertainment, etc. will coincide with the evening peak. They are assumed to make half of their trips inside downtown and half outside.

C. Corridor and Modal Allocation of Trips

The final two sets of numbers utilized in the transportation analysis are:

- The distribution of trips by corridor, and
- The distribution of trips within a corridor to modal facilities.

Modal choice is known to be a function of several variables including trip purpose, relative travel times among the available options, income level, modal accessibility, and travel cost. Several major previous transportation studies have conducted either household or person surveys to determine travel behavior. The approach utilized in this study was to examine these earlier

TABLE IV-3

Time Distribution of Shopping Trips

Season	%	Day	%
Winter	16%	9-12	20%
Spring	24%	12-2	30%
Summer	25%	2-6	40%
Fall	35%	6-9	10%

Source: Economic Resource Associates, Park Plaza Projected Characteristics of Residents, Office Workers, Retail Shoppers, and Hotel Employees, March 1975.

Boston Redevelopment Authority, Transportation Planning Department, 1975.

efforts and to select what appeared to be the most reasonable figures. These previous studies are the 1963 home interview survey of the Eastern Massachusetts Regional Planning Project (E.M.R.P.P.), the 1970 U.S. Department of Commerce Population Census, the 1972 study of Boston Parking needs by Wilbur Smith and Associates where nine major office-commercial developments were surveyed, and selected studies of individual new developments by Barton-Aschman Associates. The differences in these survey results indicate the range of uncertainty in existing modal choice.

Major access corridors are displayed in Figure II-2. Table IV-4 illustrates the allocation by corridor for trips entering the central core as determined in the 1963 E.M.R.P.P. and the 1972 Wilbur Smith surveys. The two studies obtained similar results, with both indicating a significant variation from a uniform distribution of 17%. Because the Wilbur Smith data included a further disaggregation by trip purpose and were also more current, it was decided to use these figures as a basis for distributing "outside downtown" Park Plaza trips.

Surveys of modal utilization have been conducted both for the region as a whole and for individual buildings. The results of selected individual building surveys are displayed in Table IV-5. As can be seen, variations in modal split result with geographic location and activity type. The figures also demonstrate the differences in modal use between employee and non-employee trips. Jordan Marsh is located in the heart of downtown, is directly served by two subway lines, employs largely women, and has an employment generally from the lower to middle income ranges.* All of these factors contribute to the high transit utilization. None of the surveyed developments correspond in a closely analogous way to Park Plaza. However, it can be expected that the modal allocations for Park Plaza would fall somewhere between those for Jordan Marsh and the Prudential Center.

It is further known that there is a variation in modal allocation by corridor. Results of the E.M.R.P.P. and Wilbur Smith surveys for trips entering the central core are tabulated in Table IV-6. While there is a variation in the two survey results, it was decided to use the 1972 survey results because they were both more current and more reflective of the anticipated activity mix at Park Plaza.

Table IV-7 shows the results of this survey tabulated both by corridor and by employee or non-employee (e.g. shopping trip). For trips of each type

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* The 1970 U.S. Population Census of home-to-work trips for the Boston Metropolitan area, for work trips to the central city by persons living outside the central city, showed that 69% of the women utilized public transportation whereas only 45% of the men utilized one of the available public transport modes.

TABLE IV-4

Percentage Distribution of Person-Trips by
Corridor by Employee - Non-Employee

Source	Activity Type \ Corridor	NE	N	NW	W	SW	SE	Total (3)
W.S.A. (1)	Employee	13.8	14.5	9.2	17.0	21.7	23.7	100.0
	Non-Employee	13.6	9.6	9.8	16.4	22.6	28.1	100.0
	Total	13.6	12.0	9.5	16.8	22.2	25.9	100.0
E.M.R.P.P. (2)		11	17	11	17	18	26	100.0

(1) Wilbur Smith and Assoc., An Access Oriented Parking Strategy for the Boston Metropolitan Area, Final Report, July, 1974.

(2) 1968-69 Transportation Facts - Boston Region, B.R.A., 1968.

(3) "Other" trips greater than 50 but less than 500 miles are evenly distributed among suburban corridors.

TABLE IV-5

Disaggregate Modal Split Survey Results
for Selected Developments

Mode	Jordan Marsh[1] Employee	Jordan Marsh[1] Shopping	Prudential[1] Employee	Prudential[1] Shopping	Nine Buildings Employee	Nine Buildings Non-Employee
Subway ? Bus }	71.2	65.3	26.1	22.3	39%	35%
Automobile	15.4	26.8	54.2	44.6	35%	35%
Walk	11.5	5.4	14	29.3	5%	10%
Taxi	0	.5	0	1.7	0%	4%
Commuter Rail	1.9	1.7	5	1.9	9%	3%

Mode	Jordan Marsh[2] Employee	Jordan Marsh[2] Shopping	Prudential[2] Employee	Prudential[2] Shopping
Subway	82	48	29	19
Bus	8	9	9	3
Automobile	5	22	57	47
Walk	5	19	5	28
Taxi	0	2	1	5
Commuter Rail	-	-	-	-

1. Wilbur Smith and Associates, "An Access Oriented Parking Strategy for the Boston Metropolitan Area", 1974.

2. Barton-Aschman and Associates studies for LaFayette Place.

TABLE IV-6

Comparative Corridor Modal Split Data

Corridor	Mode	% E.M.R.P.P.(1)	% 1972 W.S.A.(2)
Northeast	Auto	46	44
	Transit	54	56
North	Auto	45	41
	Transit	55	59
Northwest	Auto	49	32
	Transit	51	68
West	Auto	50	45
	Transit	50	55
Southwest	Auto	39	49
	Transit	61	51
Southeast	Auto	54	45
	Transit	46	55

(1) B.R.A., 1968-69 Transportation Facts - Boston Region, Second Edition, 1968.

(2) Wilbur Smith and Associates, "An Access Oriented Parking Strategy for the Boston Metropolitan Area", 1974.

TABLE IV-7

Modal Utilization by Corridor and by
Employee/Non-Employee (In Percent)

Mode[2] \ Corridor	Northeast		North		Northwest		West		Southwest[2]		Southeast[2]		Total	
	E	N-E	E	N-E	E	N-E	E	N-E	E	N-E	E	N-E	E	N-E
Auto[1]	36.8	53.1	38.5	44.5	25.2	40.5	42.5	47.9	31.7	40.7	41.0	33.2	36.6	42.4
Subway	46.8	32.7	37.5	30.8	60.8	46.5	33.8	32.9	44.1	38.0	35.9	48.2	40.9	37.6
Bus	9.3	12.2	6.3	10.6	5.8	8.6	17.6	16.8	7.4	14.5	18.0	18.4	12.2	14.5
Commuter Rail	6.9	1.0	17.7	14.1	8.2	4.2	6.1	2.4	16.8	6.5	5.0	0.0	10.3	5.2

Source: Wilbur Smith and Associates, "An Access Oriented Parking Strategy for the Boston Metropolitan Area", 1974.

1. Includes "taxi", "auto passenger", and "carpool".

2. "Walk" and "other" modes evenly distributed between the four major modes.

allocated to a corridor, these figures are used to determine the utilization of the various modes available within the corridor.*

Separate modal split assumptions are made for Park Plaza trips to and from downtown. These are assumed to be 60% transit and 40% walk. Because the residential areas in the Back Bay and Prudential Center lie to the west, transit trips in downtown are assumed to further split 80% and 20% for the Green Line Copley Square and Park Street approaches respectively. Hotel guests are assumed to distribute among the corridors as follows: 70% airport (northeast), and 30% evenly among the remaining 5 corridors.

* The survey results showed 22 and 16% respectively of non-employee pedestrian trips from the southwest and southeast corridors. Because downtown originating trips are treated as a separate corridor, these two walk percentages were uniformly reallocated to other modes.

V. Transportation Impacts

The specific streets, intersections, rapid transit lines and stations, and other modal facilities that most likely will be used by Park Plaza A.M. inbound and P.M. outbound travellers can be forecast using the data developed in Chapters II, III, and IV. This chapter presents the detailed results of these forecasts and identifies potential problem areas. Specific means of overcoming possible problems are discussed in Chapter VII.

The concept of a performance standard is being used throughout the Park Plaza environmental impact analysis as a means of defining an upper limit beyond which adverse impacts should not be allowed. For the case of the street system, this measure has been defined as the capacity of an intersection in vehicles per hour to handle a particular direction of movement; for example, the flow on Charles Street as it crosses Beacon Street.* For rapid transit facilities, the limiting figure is the ability of a particular line to move people in one direction by a given point; a measure commonly referred to as a scheduled capacity.

A. Assignment Methodology

The methodology is that described in Chapter I, and consists of the following six steps for each alternative for both the A.M. and P.M. peak condition:

1. Determine number of trips by activity type in peak hour.

2. Assign trips for each activity type to one of the seven defined primary access corridors, as shown in Tables V-1 and V-2.

3. Determine Modal split for trips within each corridor.

4. Assign forecasted trips for each mode and each corridor to specific modal facilities (streets, rapid transit lines), as shown in Tables V-3, V-4, V-5, and V-6.

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* Several methods of determining a highway capacity are available. All are based on empirical observation and yield a "theoretical" upper limit, based on a particular set of assumptions, that can then be used as a quantitative measure of congestion and queueing. All such capacity measures have limitations and provide only an approximate indication of the upper limit. As the data presented indicate, several intersections are presently operating either at their defined capacity flow or slightly above capacity during the peak commuting hours without producing intolerable conditions. The highway capacity methodology utilized in this study is based on data published by the Yale Bureau of Highway Traffic.

TABLE V-1

Projected Person Trips by Corridor, A.M. Peak

Corridor	Alternative				
	2	3	4	5	6
Northeast	130	282	513	830	843
North	136	259	470	798	756
Northwest	87	177	313	526	502
West	159	316	569	959	910
Southwest	203	408	728	1229	1165
Southeast	222	455	805	1357	1289
Downtown	212	358	543	783	685
Total	1149	2255	3941	6482	6151

TABLE V-2

Projected Person Trips by Corridor, P.M. Peak

Corridor	Alternative				
	2	3	4	5	6
Northeast	138	428	721	1083	1038
North	144	342	574	937	884
Northwest	93	253	407	654	624
West	170	445	725	1172	1115
Southwest	218	582	938	1517	1444
Southeast	238	664	1057	1704	1629
Downtown	497	856	1186	1571	1590
Total	1498	3570	5608	8638	8324

TABLE V-3

Projected Vehicle Trips by Corridor, A.M. Peak

Corridor	Alternative				
	2	3	4	5	6
Northeast	34	74	135	219	221
North	37	71	129	219	208
Northwest	16	32	56	95	91
West	49	96	173	291	276
Southwest	46	92	165	279	264
Southeast	65	134	235	397	378
Downtown	-	-	-	-	-
Total	247	499	893	1500	1438

TABLE V-4

Projected Vehicle Trips by Corridor, P.M. Peak

Corridor	Alternative				
	2	3	4	5	6
Northeast	36	113	189	285	274
North	39	94	158	257	243
Northwest	16	46	74	118	113
West	51	135	220	356	339
Southwest	49	131	212	344	327
Southeast	70	194	310	499	478
Downtown	-	-	-	-	-
Total	261	713	1163	1832	1774

TABLE V-5

Projected Transit Trips by Corridor, A.M. Peak

Corridor	Alternative				
	2	3	4	5	6
Northeast	61	132	240	389	396
North	51	97	176	299	284
Northwest	53	108	190	320	305
West	54	107	192	324	308
Southwest	90	180	321	542	514
Southeast	80	163	289	487	464
Downtown	127	273	326	470	411
Total	516	1060	1734	2831	2682

TABLE V-6

Projected Transit Trips by Corridor, P.M. Peak

Corridor	Alternative				
	2	3	4	5	6
Northeast	65	200	338	508	486
North	54	128	215	351	332
Northwest	57	154	247	398	379
West	57	151	245	396	377
Southwest	96	257	414	669	637
Southeast	85	238	380	612	585
Downtown	298	514	712	943	954
Total	712	1642	2551	3877	3750

5. Add projected increment of Park Plaza trips to existing volume, determine percent increases, and compare projected new volume to existing or committed capacity.

6. Adjust projected traffic flows to 1985 base year conditions, allowing for projected changes in existing conditions.

B. Forecast Volumes Resulting From Park Plaza

This section presents the results of the trip calculations for each of the five Park Plaza density alternatives. As a basis for the discussion, Tables V-1, V-2, V-3, V-4, V-5, and V-6 show the projected person, vehicular, and transit trips by corridor during the peak hours for each alternative, based on an assumed vehicle occupancy of 1.4. The differences between the A.M. and P.M. peak for an alternative result from the differences in the number of trips generated by each activity type between the morning and evening hours. The P.M. figures are higher than the A.M., reflecting an increased level of both retail and hotel activity relative to the morning. The five million alternative is shown as generating more trips during both the A.M. and P.M. peak hour than the six million option. This is caused by the change in the mix of office and residential space with the six million option having more residential units and less office space than the five million choice. This distribution of activity type accomplishes lower peak period trip making and a better balance of outbound and inbound flows.

The maps and tables included as Appendix A display the detailed analysis results for each alternative:

- map of forecast A.M. peak hour vehicle volumes destined to Park Plaza
- map of forecast P.M. peak hour vehicle volumes originating from Park Plaza
- table of forecast A.M. peak hour street intersection flows of vehicles destined to Park Plaza
- table of forecast P.M. peak hour street intersection flows of vehicles originating from Park Plaza
- table of forecast A.M. peak hour transit trips directed to Park Plaza
- table of forecast P.M. peak hour transit trips leaving Park Plaza

The maps and tables focus on primary access corridors serving Park Plaza. Streets such as Boylston and Tremont Street are not expected to serve in such a role because of the planned Stuart Street orientation of the parking facility. Boylston and Tremont Streets, however, would undoubtedly receive a small amount of additional traffic, but considerably less than the amounts shown for other streets.

Analysis of the tables show that the M.B.T.A. transit system will have sufficient capacity in 1985 to easily handle even the largest forecast increment of Park Plaza trips. The worst case is the P.M. peak hour for the five million alternative, and this can be examined as an illustration. M.B.T.A. Green line westbound trips are increased by 1150 or 14.2%. The 1975 total would be 9250 trips, and in terms of 1985 base year, the new total would be 10,240 or a volume/capacity ratio of .64. The increment of Green line eastbound riders is 1854, yielding a 1985 volume capacity ratio of .68. These figures indicate that even if the planned Green line improvements are only modestly successful, the Green line would have sufficient capacity to handle any of the proposed five alternatives.

Maximum additional Green line station loadings would be 1854 at Boylston and 1150 at Arlington during the P.M. peak for the 5 million alternative. Both stations have sufficient capacity to handle this magnitude of an increase. In addition, as discussed in Chapter II, it is likely that some potential Red line riders will choose to walk from Park Street rather than use the Green line.

Of the three remaining M.B.T.A. rapid transit lines, the five million option would most affect the westbound Orange line and the northbound Blue line during the P.M. peak hour. The Orange line has sufficient 1975 capacity to handle the projected increase in Park Plaza trips but some of this excess capacity would be taken up by 1985 with the addition of other new trips. A similar condition applies to the possible 6.5% increase in Blue line riders. In examining the forecast 1985 .94 and .99 volume/capacity ratios, it should be remembered that the indicated scheduled capacities for both the Blue and Orange lines do not account for any capacity increase that may result with the scheduled extensions of these two lines.

Unlike the transit system, the local street system already has several streets and intersections that would be affected by Park Plaza that are already operating at or near their theoretical capacities. The tables assume the new street circulation pattern associated with Park Plaza. However, since traffic signal timings, parking regulations, lane markings, traffic islands, and other detailed traffic engineering adjustments have not yet been designed, and because available data reflect current facilities, the capacity figures shown in the tables are based on existing conditions. In all cases, the cycle length and phasing of the traffic signals

could be adjusted to account for the changed pattern of traffic flows and thus increase intersection capacity. Consequently, the indicated volume/capacity ratios after Park Plaza represent an overly high or conservative figure. The exact magnitudes of capacity increases that may be possible are presented in Chapter VII.

Tables V-7 and V-8 indicate for each alternative the street intersections where congestion is likely to occur during the A.M. and P.M. peak hours. Again, the five million alternative can be examined as the worst case. During the A.M. peak, problems can be expected at the intersections of Columbus-Arlington-Stuart and Dartmouth-Columbus. At Dartmouth-Columbus, Park Plaza would add approximately 285 vehicles each from the west (Mass Pike) and southwest corridors, or 66% and 33% above the existing volumes. For the two million alternative, in contrast, these flow increases are reduced to 11% and 6%. As developed in Chapter VII, capacity improvements are possible at this intersection which would reduce the 5 million volume/capacity ratio to less than 1.0.

Traffic from four of the six radial access corridors must pass through the Columbus-Arlington-Stuart intersection, resulting in flow increases from 11% to 112% for the three streets for the five million alternative and 1985 volume/capacity ratios of 1.5 to 2.1 during the A.M. peak. This intersection will be most seriously affected by Park Plaza and while the capacity improvements developed in Chapter VII can significantly help, they will not entirely eliminate congestion during the peak periods for the four, five, and six million options.

Intersection conditions during the P.M. peak hour show an analogous pattern to the A.M. peak, with the worst congestion occurring in the north, northwest, west, and southwest corridors. A worsening of problems could be expected at Beacon-Arlington (+16%) and Beacon-Berkeley (+11%). New problems would be caused at Columbus-Arlington-Stuart (+161%) and Dartmouth-Columbus (79%). As in the A.M. peak, Columbus-Arlington-Stuart is the worst of the four problems with a volume/capacity ratio of 1.6. As developed in Chapter VII, capacity improvements are possible which would reduce this to less than 1.0. Similarly, the three volume/capacity ratios of 1.27, 1.03, and 1.17 can be reduced through changes in traffic signal timings and other capacity improvements.

In summary, the larger Park Plaza alternatives will result in congested conditions at two intersections during both the A.M. peak hour and at four intersections during the P.M. peak hour unless the mitigating measures developed in Chapter VII are implemented. The most serious intersection is Columbus-Arlington-Stuart where other than standard traffic engineering improvements are required..

TABLE V-7

Projected Congested Intersections

A.M. Peak Hour

Intersection	Alternative				
	6	5	4	3	2
Beacon-Clarendon					
Beacon-Arlington					
Boylston-Clarendon					
Boylston-Arlington					
Columbus-Arl.-Stuart	X	X	X	X	X
Washington-Stuart					
Dartmouth-Columbus	X	X	X	X	X
Commonwealth-Arling.					

TABLE V-8

Projected Congested Intersections

P.M. Peak Hour

Intersection	Alternative				
	6	5	4	3	2
Beacon-Arlington	X	X	X	X	X
Beacon-Charles					
Boylston-Charles					
Columbus-Arl.-Stuart	X	X	X	X	
Washington-Stuart					
Dartmouth-Columbus	X	X			
Arlington-Mass Tpke.					
Beacon-Berkeley	X	X	X	X	X

The effect of each of the Park Plaza alternatives on the commuter rail system is shown in Tables V-9 and V-10. Ridership increases of from 1% to 7% are forecast. 1975 seated capacity of both the Penn Central and the Boston & Maine lines is sufficient to absorb this increase. The capacity improvements to be developed with the Commuter Rail Improvement Program would add further to the commuter rail system's ability to serve Park Plaza. If the level of service also is substantially improved, this could divert trips from other modes.

C. Demand for Parking

The primary focus of this report, and of the discussion in all other sections, is the transportation impact of Park Plaza external to the site area itself. Separate components of the overall design and environmental analysis are concerned with pedestrian and vehicle circulation internal to the site. An important impact, though, is parking and the increased parking demands that may be placed on nearby parking facilities, especially on-street parking in residential areas.

To estimate the demand for parking beyond the site area, an analysis has been performed of projected parking movements and demand for the planned Park Plaza parking facility itself. Any vehicular demand that exceeds the planned capacity will represent an additional demand, or impact, placed on neighboring facilities.

The projected transportation volumes resulting from Park Plaza are based on the projected new employee and visitor population. Since the new parking facility will serve all trips destined for the Park Plaza site - both old and new - since it is replacing the Eliot and Motor Mart Garages. This new population, however, will be less than the total population of the site area for all but the 6 million alternative since not all buildings will be replaced for the lower density options. Rather than assuming the existing occupancy of these two garages as a base occupancy for the new Park Plaza facility, it was instead decided to factor up the projected new Park Plaza employee and visitor population figures in order to represent a more valid estimate of the total employee and visitor populations within the site area. This assumes that both the old and new buildings will have approximately the same trip making patterns. Factors have been derived for retail and office employees and for retail and office visitors. For a particular alternative, the ratio is equal to the total office or retail floor space divided by the new space to be constructed. The difference then represents space retained. The derived factors are listed in Table V-11.

To estimate the total demand for parking, the following assumptions were made:

TABLE V-9

Park Plaza Commuter Rail Volumes

A.M. Peak

	Penn-Central		Boston & Maine	
	Increment	Total	Increment	Total
6 Million	316	4846	233	5438
5 Million	334	4864	242	5447
4 Million	198	4728	145	5350
3 Million	111	4641	79	5284
2 Million	54	4584	40	5245
1975 Volume	4530		5205	
1975 Seated Capacity	4872		5115	
Estimated Future Capacity	5600		5880	

TABLE V-10

Park Plaza Commuter Rail Volumes

P.M. Peak

	Penn-Central		Boston & Maine	
	Increment	Total	Increment	Total
6 Million	392	4922	279	5484
5 Million	413	4943	294	5499
4 Million	255	4785	185	5390
3 Million	159	4689	111	5316
2 Million	60	4590	43	5248
1975 Volume	4530		5205	
1975 Selected Capacity	4872		5115	
Estimated Future Capacity	5600		5880	

TABLE V-11

Ratio of Total Floor Space within Completed Site Area to New Floor Space to be Constructed

Alternative	Office	Retail
6 Million	1.	1.
5 Million	1.	1.1
4 Million	1.17	1.25
3 Million	1.67	1.62
2 Million	2.54	3.0

Source: Boston Redevelopment Authority data, 1975.

hotel - 1 vehicle for each 2 units

residential - 1 vehicle for each unit

employee and visitors - the number of vehicular arrivals as determined in the analysis described in Section B of this chapter, scaled by the appropriate factor.*

It is further assumed that vehicles will arrive and depart throughout the day so that the garage will be able to handle a total daily demand that exceeds its vehicular capacity, and that parking spaces will not be reserved for the exclusive use of a particular activity type. Since the time of peak parking demand will vary with activity, maximum garage utilization is accomplished through the multiple use of space. For example, peak hotel and residential use will be at night, while peak visitor and employee demand will be during the day. Occupancy by time of day assumptions are tabulated in Table V-12, corresponding to the distribution of trips by time of day presented in Chapter IV. A uniform length of stay of two hours is assumed for all visitors (based on results of the Wilbur Smith and Associates parking survey, Boston, 1974).

The results of the parking analysis for each alternative are presented in Appendix B. The time of peak parking demand occurs in mid-afternoon when all but the two million alternative indicate a parking demand that exceeds available supply. In summary:

- The 3131 parking spaces are sufficient for the 6 million alternative. The 3:00 P.M. 151 vehicle deficiency can easily be handled by the Boston Common Garage and other nearby facilities, assuming current occupancy levels are a an indication of future utilization.

- The 2056 space garage for the 5 million alternative results in the largest deficiencies of the five alternatives with parking spill-over likely to occur throughout the afternoon. This deficiency results from the higher office population combined with the smaller garage relative to the 6 million alternative. Still, the peak 1210 vehicle deficiency could be absorbed by the currently available excess parking capacity near the site area identified in Chapter II.

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* This is equal in magnitude to assuming a uniform auto mode split of 35% and an auto occupancy of 1.4 applied to the projected total population.

TABLE V-12

Garage Occupancy by Time of Day

Activity Type	% 6 AM	% 9 AM	% 12 noon	% 3 PM	% 4:30 PM	% 6 PM	% 9 PM
Employees	0	70	90	100	75	30	0
Non-Employees	0	10	10	30	25	15	10
Hotel	100	60	20	30	50	50	100
Residents	100	60	40	40	70	80	100

- The 1575 and 1395 parking spaces provided for the 4 and 3 million options respectively result in a parking deficiency throughout the day, though with a lower peak than for the 5 million alternative. Maximum demand for the 4 million alternative is estimated as 2707 vehicles and for the 3 million alternative as 2255 vehicles. Based on the parking figures developed in Chapter II, currently available excess parking capacity in the Park Plaza area is sufficient to handle the projected parking deficiencies. Because of the higher ratio of employee parking demand to available supply, relative to the 5 million alternative, it is likely that the 4 and 3 million options would result in at least as high a parking demand on nearby on-street parking as would be 5 million option even though the total number of employee trips is lower.

- The 1400 space parking facility to be built in conjunction with the 2 million alternative is sufficient to handle parking demands throughout the day; no periods of parking deficiency are forecast.

D. Transportation Related Issues

Several specific community issues have been raised in the course of performing the transportation and parking analyses that are related, either directly or indirectly, to the movement of persons and vehicles to and from Park Plaza. These issues are addressed in the following paragraphs.

Effect of New Charles Street on Through Traffic -

Concern has been expressed that the construction of new Charles Street and the associated improvements of traffic flow in what is now Park Square will encourage traffic through Bay Village and Beacon Hill. While some impact of this nature will undoubtedly happen, it is expected to be much less than other sources of traffic growth. Because of the basic geography of Boston and Storrow Drive, it is expected that other streets, such as Berkeley and Dartmouth, would continue to serve the majority of through trips. New Charles Street would be used for trips turning off of Stuart-Kneeland Streets and for local circulation within the downtown area.

Relation of Park Plaza and Hancock Tower Traffic -

Both Park Plaza and the new Hancock Tower represent new and large developments that could potentially generate new vehicular traffic on the same Back Bay Streets because of their

proximate location. Because of the location of ramps on both the Massachusetts Turnpike and Storrow Drive and the associated one-way street patterns, much of the potential conflict between these two developments is minimized for trips originating from and destined to the defined primary access corridors. From the west, both developments will use the Prudential Center Turnpike exit, but will utilize different ramps. From the southwest corridor, both developments will utilize Columbus Ave., thereby causing increased congestion. From the northeast and north both developments would use the Arlington St. exit from Storrow Drive, though the trips would split at Beacon St. In the outbound direction, some overlap would occur on Berkeley Street. Trips from the northwest would result in no conflict. Trips from Sumner/Callahan tunnel to the Hancock Tower would likely use Stuart-Kneeland St. and cause some increased traffic loadings.

The Hancock Tower will have been fully occupied and local street circulation patterns stabilized by the time detailed design of Park Plaza signal timings and street circulation is performed. This will permit a design that can minimize any areas of potential conflict.

On-Street Parking in Bay Village and Back Bay Residential Areas -

For all but the two million alternative, increased demands are likely to result for available on-street parking in the adjacent residential areas. This will result from the projected parking deficiencies within the site area itself combined with people's natural desire for free on-street parking. This demand would be further increased if employee parking were either prohibited or minimized in the new Park Plaza garage. Bay Village would be potentially most seriously affected. While the parking deficiency within the site area is relatively large for the 3, 4, and 5 million alternatives, sufficient excess capacity in nearby garages and lots is available to handle the entire excess demand. Incentives for persons to use these spaces or to use transit rather than park in scarce on-street space can be provided by proper design of pricing structures and by banning parking in residential areas to all but local residents. Such measures are described in more detail in Chapter VII.

Traffic Increases on Local Streets -

The local streets of South Cove, Back Bay, and Beacon Hill should not be significantly affected by increased through traffic resulting from Park Plaza. Charles St.. Arlington St., Berkeley St.,

Clarendon St. and Commonwealth Ave. already act as major arterials and the findings previously presented indicate the potential magnitude of increased traffic on these streets. Streets such as Boylston, Tremont, and Commonwealth are not likely to serve as major access routes to Park Plaza; they will, however, pick up additional secondary or local circulation type of traffic. Volumes on Charles will likely increase from 2%-13% during the P.M. peak hour. The five million and four million alternatives would add approximately 130 and 80 vehicles respectively.

Pedestrian Movement

An existing community objective in the South Cove area is improved pedestrian access. As developed in Chapter III, the proposed configuration of both north-south and east-west pedestrian paths should result in considerably improved pedestrian circulation both within and across the site. This is especially true for north-south directed pedestrian movements that are presently made difficult by the physical arrangement of Park Square.

VI ASSUMPTIONS AND UNCERTAINTY

The results described in Chapter V are based on several key assumptions and also, as in any analysis of this type, have certain inherent uncertainties. These have been noted in the text at the appropriate places. The following represents a summary of what we believe to be the more important items, along with an indication of any bias that might result.

A. Major Areas of Uncertainty

1. A major uncertainty concerns the population size and characteristics of each of the five basic Park Plaza alternatives. The effect of an underestimate is that an alternative would assume the characteristics of a higher density option.

2. Data on the distribution of Park Plaza trips by time of day is dependent on the particular mix of tenants, operating hours, and management strategy employed. The assumed distributions are felt to be realistic, and possibly somewhat conservative, based on the data available. As noted below, however, they do not account for any possible 15 and 30 minute peaking that may occur.

3. It is likely that some changes in modal choice will occur over the next 10 - 15 years. The Commonwealth has recently completed a period of major new expressway construction which has resulted in an increase in automobile trips crossing the cordon line and a decrease in the utilization of all forms of public transit. The current policy, though, is to promote transit, and several major transit improvement projects are now in the final stages of design. This major change in state transportation policy combined with the city's freeze on new parking construction should increase transit utilization and decrease reliance on the private automobile. The exact timing and magnitude of this shift, however, is uncertain. Use of current modal split distributions as a basis for a 1985 analysis should over-estimate auto trips if the policy works as intended.

   As one example, there is uncertainty regarding the exact ridership effects of both the commuter rail improvement program (CRIP) and the Orange Line relocation. If CRIP results in major increases in commuter rail usage, part of this growth could come from existing auto trips, and in the case of some Penn Central lines, from M.B.T.A. Green Line. Also, growth in Orange Line usage is likely to come partly from a diversion of existing Green Line riders. In each of these cases, the effect is to reduce a potentially adverse transportation impact.

4. The U.S. Environmental Protection Agency in cooperation with the Commonwealth is implementing a program to reduce utilization of single

passenger automobiles for home-to-work commuting. The program includes both a ban on on-street parking between 7:00 and 9:30 A.M. in Boston and the use of employer-based carpool programs. The effectiveness of these and other controls are highly uncertain because the level of effort to obtain successful results will be high. Assuming these controls are successfully implemented and that they are effective implies that use of current modal allocations could over-estimate peak hour automobile trips by as much as 10-15%.

5. 15 major redevelopment projects in downtown Boston are in various stages of planning, design, and construction, with approximately 80% of the identified office and retail development now in various stages of construction. Uncertainties concern the final mix of projects that will be implemented, their actual (as opposed to planned) population characteristics, the sequence in which they will be opened for occupancy, and their effect on travel behavior. An estimate of 20% growth in downtown employment over the next ten years is felt to be realistic. If actual growth is less than this amount, the analysis results would tend to over-estimate the severity of transportation impacts.

6. There is an uncertainty in the way both regional and central city land-use is likely to change over the next ten years. Past years have seen a decentralization in both employment and population from the older core cities. The Boston Transportation Planning Review identified the areas outside Route 128 as the growth portion of the region. They also stated though that portions of the central city "can be expected to, at a minimum, retain their current population and jobs."* Transportation patterns will change in close association with land-use and consequently 1985 or 1990 travel behavior in the vicinity of Park Plaza could be different than now anticipated.

7. Existing street flows, turning movements and M.B.T.A. ridership is based on traffic count data available from city and State sources. No new data were collected as part of this study. As such, not all existing conditions are based on the same base year and in some cases there are inconsitencies in the available data.

   The uncertainties resulting from these conditions are not felt to be sufficiently large to change any of the findings or recommendations. The variability in existing data provides an indication of the uncertainty in that data. As the findings presented in Chapter V indicate, in many cases this variability is approximately the same as or only somewhat lower than the projected percentage increase in traffic resulting from Park Plaza. This implies that while Park Plaza will increase certain traffic flows, the magnitude of the increase is within

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* Boston Transportation Planning Review, "Regional Framework", October 1972, page 2.

the current day-to-day or month-to-month variation of existing conditions.

Available intersection turning movement counts range in age from 1965 to 1973. While this results in a variability from one intersection to another, this is not felt to be larger than normal daily variations in local street traffic given the relative stable cordon counts on local and arterial streets during this period. Local street link volumes are derived from adjacent intersection counts. The link volumes used in the analyses represent a balanced flow condition, achieved through an iterative balancing of intersection input and output flow data.

M.B.T.A. rapid transit ridership is based on line or characteristic counts rather than on published turnstyle counts since the characteristic count, though containing more uncertainty than a station turnstyle count, gives an estimate of riders passing a given point in one direction by time of day. Such a Green line count taken between Arlington and Boylston Stations was available from December, 1974. Similar counts for the Red, Orange, and Blue lines in the downtown area are based on 1965 data. For the analysis, these counts have been factored downward by 6% to reflect the observed decrease in transit trips crossing the Boston cordon line.

B. Major Assumptions

1. The M.B.T.A. Green Line capacity is based on the planned 1975-76 implementation of the new articulated light rail vehicles, and the associated improvements in power, communication, and vehicle reliability. It is assumed that these changes will achieve at least a portion of the planned increase in scheduled peak hour capacity to 16,000 persons per hour per direction.

2. The new M.B.T.A. South Cove Station is assumed to serve as the Park Plaza station for all southwest corridor transit trips using the Orange line. If the relocated Orange line is not open as is now planned by 1985, then this traffic would utilize the Essex Station. A shift in Green line ridership to a relocated Orange line, which the M.B.T.A. anticipates to occur, has not been incorporated into this analysis.

3. All changes in street circulation incorporated in the Park Plaza design are assumed to be implemented in performing the transportation analysis. These include new Charles and Eliot Streets and the upgrading of Stuart Street, as described in Chapter III.

4. Street access to Park Plaza via each of the defined corridors is assumed to be by one or at the most two routes. This approach does not consider secondary routings such as Cambridge Street, Tremont Street,

or New Essex Street (if constructed) which will likely handle at least a portion of Park Plaza trips. Therefore, the predicted increases in traffic on the identified streets will tend to be over-estimated. Actual traffic will be distributed more widely than indicated, though the absolute magnitude of these secondary effects should be minimal.

5. No separate analysis has been made of possible 15 or 30 minute peaking on either the Green line or the local street system. It is felt that additional peaking caused by this effect could be handled by the improved Green line. In addition, the mix of planned Park Plaza activities should result in a natural staggering of work hours.

6. Parking access and egress is assumed to be by two pairs of ramps located at the easterly and westerly ends of the garage. The westerly ramps connect to Stuart Street, while on the easterly end, access is from Stuart Street and egress is onto Tremont Street. In addition, garage access and egress is assumed for Eliot Street. Major changes in these access patterns could change both the location and the magnitude of the predicted increases in local street congestion.

7. Allocation of the available parking garage spaces for each alternative is as described in Chapter V and assumes multiple utilization of individual stalls. That is, a space may be used for hotel, retail, or employee parking, depending on local demand. Also, a parking pricing policy is assumed which discourages day long or office employee parking and which encourages (or at least does not discourage) short term retail parking. Additionally, self-parking is assumed with an automated ticket spitter at each entrance, with payment on exit. Office parking is assumed to be by pre-paid pass.

8. No estimates have been made as part of this analysis of freight or service movements to and from Park Plaza or of taxi trips serving the various Park Plaza activities. A separate underground service roadway system is planned as part of the development. The roadway will serve each building and will have its entrances and exits on Stuart Street at the same curb locations as the two primary garage access/egress points. All service movements should be scheduled so as to avoid the two peak hours. Taxi stands are to be provided along relocated Eliot Street. These parking areas should be designed so that they are sufficient to avoid any blockage of normal street auto flow. Such blockage could be particularly critical during the evening peak hour for the larger scale alternatives.

9. No differentiation has been made in modal usage by either income level or by sex, although such differences are known to exist. Detailed population data on these characteristics have not been developed by either the B.R.A. or by Economic Research Associates. Accounting for these factors likely could result in a shift in predicted modal choice

from auto to transit, thereby lessening any anticipated increases in local street congestion.

10. It is assumed that the effects of traffic increases resulting from planned new construction in downtown Boston from 1975 to 1985 are offset in part by (a) current Park Square area trip making which will be displaced or removed by the Park Plaza development and (b) some portion of the "new" Park Plaza trips which in reality represent simply a relocation in either origin or destination of trips already being made today.

11. Some temporary adverse transportation impacts in the immediate area are likely to occur during the period of Park Plaza construction. These would be caused by the movement of construciton related vehicles to and from the site, the reduced parking supply available during construction, and the increase in parking demand caused by the construction work force. The detailed analysis of such effects was not included as a part of this study.

12. The office building population characteristics furnished by the B.R.A. assume a "standard" commercial occupancy. Use of part or all of the planned office complex as a state office building could change the predicted population characteristics, and consequently both the transportation and parking garage analyses.

13. No special allowance has been made for the planned Statler-Hilton improvement program, its transportation aspects and any possible cooperative features with Park Plaza. However, in accounting for new developments (Table III-6), conversion of the current Statler-Hilton office space to hotel space is assumed in forecasting 1985 employment levels. Since periods of peak hotel related travel do not normally coincide with peak commuting times, the primary effect of the expanded hotel facility will not be in the contribution of new peak hour trips but rather in influencing the efficiency of the immediately adjacent local street circulation patterns.

14. Occupancy of Park Plaza is assumed to occur in 1985. In reality, construction of all alternatives will be staged with occupancy starting in 1980 and being completed in 1990. This implies that changes in travel demand caused by Park Plaza will occur in relatively small increments spread over approximately a ten year period of time. Any single increment caused by the opening of either an entire or part of a building will be much smaller than the numbers indicated in Chapter V. The transportation system will adjust continuously to each of these small increments of additional traffic so that it remains in equilibrium. The timing of traffic signals or the operation of the parking garage easily can be adjusted to alleviate

any unanticipated difficulties. Changes in modal choice and routings will occur if congestion from Park Plaza and other developments become worse or if adequate parking is not available. This continuous equilibrium adjustment during the ten year 1980 - 1990 period means that the transportation effects identified in Chapter V should be less serious than actually predicted.

VII MITIGATING MEASURES

Several possible kinds of responses can be made to achieve an acceptable transportation equilibrium in response to an increased travel demand. These include the addition of new capacity to the street and transit systems, the undertaking of either voluntary or required mechanisms to better manage the flow of trips, and the shifting of travel times and routings to achieve less congested conditions. This chapter outlines recommended courses of action that should be undertaken by the City, the Commonwealth, and the Park Plaza developer to either eliminate or minimize adverse transportation impacts of Park Plaza. The discussion is both general, presenting measures that apply to all alternatives, and alternative specific, defining measures that need to be undertaken for only one or more of the density options. The discussion is structured by the type of mitigating measure proposed. For each measure, the potential applicability to individual alternatives is then specified. A tabular summary of the measures proposed is presented in Table VII-1. Each of these is described in more detail in the following sections.

In discussing possible mitigating measures, it is important to keep in mind the natural changes in trip-making patterns that persons will make after changes are made in existing transportation facilities as well as overall demand increases. Experience shows, for example, that demand for transport facilities will shift as a function of the supply of transportation available; that is, if sufficient peak capacity does not exist, trip-making patterns will be adjusted in terms of both time and facilities utilized until an equilibrium condition is reached. Traffic will be diverted to other routes, transit lines, or parking lots; traffic will shift among the various modes, with perhaps an increase in walk trips from the Red Line rather than transferring to the Green Line at Park Street; auto users may respond to traffic and parking problems by forming carpools, perhaps aided by employer or developer incentives; close in vehicular trips may become walk trips; and trips will be spread more uniformly throughout the peak. Also, as demand approaches the capacity of a facility, some discretionary trips will simply not be made or trip-making patterns will become more efficient by combining multiple trips into a single trip. All of these actions that occur voluntarily by individuals will help to minimize any potentially adverse transportation impacts.

A major source of adverse transportation impacts is the characteristic peaking of the employee work trip. This effect can be seen in the results presented in Chapter V where the transportation impacts of the 5 million sq. ft. option are shown to be worse than for the 6 million option due to the larger number of office workers in the smaller density package.

A. Improvement of Street Intersection Capacity

Improvements can be made to the timing and phasing of individual traffic

TABLE VII-1

IMPROVEMENTS TO ELIMINATE OR MINIMIZE
ADVERSE TRANSPORTATION IMPACTS

Measure	Alternative				
	6	5	4	3	2
Improved Intersection Signalization	x	x	x	x	x
Improved Parking Access	x	x	x	x	
Parking Operation	x	x	x	x	x
Modal Choice Incentive/Disincentive	x	x	x		
Local Street Circulation	x	x	x		
Management of Work Hours	x	x			
Public Transportation					

signals to achieve increased intersection capacity, and thereby an ability to handle a higher level of street volumes during both the A.M. and P.M. peak hours. These improvements can provide sufficient additional intersection capacity at Beacon-Arlington, Dartmouth-Columbus, and Beacon-Berkeley so that the queueing that will exist during the peak periods for each of the five density alternatives will not be significantly greater than that which now occurs. The single worst intersection condition occurs during the A.M. peak with the northeast bound leg (Columbus Avenue) of the Arlington-Columbus-Stuart intersection where a volume/capacity ration of 2.1 is calculated for the five million option. Improved signalization, by itself, can only reduce this to 1.2 so that significant queueing would likely still form.

There are three reasons why modified traffic signalization schemes are possible. First, the basic street pattern will be changed by Park Plaza. For example, the removal of Columbus Avenue to the east of Arlington Street means that significantly higher flows can be handled in the remaining directions of movement. Second, the revised pattern of turning movements and relative directional flows with the addition of Park Plaza trips means that the most efficient cycle length and phasing may differ from that now in use. Third, the higher volume levels may mean that certain channelization and other traffic flow improvement schemes will be cost-effective after Park Plaza where they were not economically efficient before. In all cases, the capacities utilized in the Chapter V analyses are the existing intersection capacities. The indicated volume/capacity ratios therefore are on the conservative side.

The most seriously overloaded intersection for each of the five alternatives is the new Columbus-Arlington-Stuart intersection, having potentially the worst congestion and queueing of all intersections near Park Plaza. Allowing for a 15% growth in existing traffic, volume/capacity ratios of 1.5 and 1.7 are predicted for the 6 and 5 million alternatives respectively during the P.M. peak. During the A.M. peak, the analogous ratios are 2.0 and 2.1. Currently the intersection is six-way and has three signal phases. With the planned street changes, Columbus Avenue would be increased from two to three travel lanes and the signalization possibly could be reduced to two phases during the P.M. peak. Using the projected P.M. peak 5 million alternative trips, capacity improvements of approximately 800 vehicles/hour are possible on the critical Arlington Street leg by reducing the volume/capacity ratio to .85. Assuming continuation of a three phase signal, light retiming can only reduce the volume/capacity ratio to 1.0,and this allows only a minimal pedestrian phase. For the P.M. 4 million option and a three phase signalization, sufficient new capacity can be obtained to produce a volume/capacity ratio of 1.0 on the critical Arlington Street phase, assuming continuation of the existing pedestrian phase length and the effective ban of on-street parking on Arlington to permit at least 3 moving lanes of traffic.

During the A.M. peak, continuation of a three phase signal is necessary

because of the merger of five lanes of inbound traffic from Columbus Avenue and Stuart Street into 3 lanes and the close proximity of the Park Plaza garage entrance ramp to the intersection. Preliminary analysis of revised signal timings indicate that reductions of volume/capacity ratios to only 1.1 - 1.2 are possible with the 6 and 5 million alternatives and to 1.0 with the 4 million density. These would still result in the formation of large and continuous queueing due to downstream lane merging on Stuart Street and weaving movement bound for the garage ramp. Traffic for the 3 and 2 million options, however, would be workable. For the 6, 5, and 4 million options, additional mitigating measures would be necessary in the form of either (a) a significantly re-designed intersection, (b) revision of the access and local circulation flows to reduce the traffic passing through this intersection, or (c) re-design of the garage access/egress ramp locations. Three other intersections which the analysis shows to be critical are Beacon-Berkeley Streets, Arlington-Beacon Streets, and Columbus Avenue - Dartmouth Street. The projected volume/capacity ratios for the 5 million alternative are 1.17 (P.M.), 1.27 (P.M.) and 1.34 (A.M.) respectively. It is estimated that retiming of these signals could reduce each of these figures to less than 1.0 assuming existing pedestrian phase lengths.

In summary, retiming should be performed on the traffic signals for the four intersections identified as being important for Park Plaza trips during the A.M. and P.M. peaks. Such retiming is essential for four intersections for the 5 and 6 million alternatives, three for the 4 and 3 million densities, and two for the 2 million choice. Signal retiming would be a sufficient mitigating measure for the 2 and 3 million alternatives but is insufficient to cure the projected overloading during the A.M. peak at Columbus-Stuart-Arlington for the 6, 5, and 4 million densities.

B. Parking

The data developed in Chapter V indicate that the demand for parking is likely to exceed available supply for all Park Plaza alternatives except the 2 million option, with the most serious problem occuring in the 5, 4, and 3 million sq. ft. options. In addition, peak period garage access and egress is likely to be a problem for all options above 2 million sq. ft.

Mitigating measures affecting parking concern both the physical design of the proposed parking facility and the policy and pricing structure under which the garage will be operated. The recommended measures affecting operation and pricing should be followed for all alternatives; the measures concerning garage access and egress are felt to be essential for the 6, 5, 4, and 3 million options.

Additional access from the western side should be provided from either Arlington or Boylston Street. As presently designed, traffic from four of the six major access corridors must pass through the intersection of Arlington, Columbus and Stuart Streets. Provision of an additional secondary access ramp, possibly connecting off of Arlington Street to the primary

ramp, would help relieve the anticipated congestion at this interchange.

Access on the east end should be provided from Eliot Street, either instead of or in addition to Tremont Street. Because of local circulation patterns and the anticpated use of Kneeland-Stuart Streets as a primary access route, Tremont Street garage access provides only very limited benefit.

Consideration should be given to providing egress onto Tremont Street. As the street system is now planned, it is not possible to exit from the east end of the parking facility and immediately leave the site area. An exit onto Tremont Street would permit a left turn on Stuart Street for a direct approach to the Central Artery and Southeast Expressway. In addition, a direct means of egress onto Columbus Avenue should be provided on the westerly end. If trips heading west and southwest do not have to use Arlington Street, this would help to alleviate the capacity problems during the P.M. peak on this leg of the Stuart-Columbus-Arlington intersection. Provision of additional exit ramps also would help to reduce potential garage related congestion during periods of peak demand such as large conventions or entertainment functions.

Parking operation should minimize the barriers to easy, fast access and egress. Entrance should be by either ticket spitter or parking card. Monthly or annual parking payment should be available to permanent parkers along with window stickers, to enable immediate exit.

Parking pricing should be structured to reduce the demand for all day employee parking. To promote non-employee shopping trips, the effective price for this kind of parking should be as low as possible, and should include use of store validated parking rebates.

Available parking spaces should not be allocated exclusively to either a single activity or single user. Because of the high demand for parking and the desire to keep parking off of adjacent area residential streets, each parking space should be utilized for multiple purposes. While guidelines such as one parking space for each living unit and one space for each two hotel rooms are useful, rigid adherence would result in inefficient use of the parking facility. A strict policy of providing either no or only very limited employee parking would increase parking demand in nearby facilities and on local streets.

Parking preference in terms of both access and location should be given to multiple occupant vehicles for all employee parking. Consideration might even be given to a policy which would prohibit all single occupant employee autos from using the parking facility.

C. Modal Choice Incentives and Disincentives

The most serious adverse transportation impacts for all options relate to

intersection congestion and excess demand for parking. To discourage the use of private automobiles, especially for employee commuting, an organized program combining both incentives and disincentives should be implemented to encourage the use of public transportation modes where adequate excess capacity exists. These modal choice incentives and disincentives should be incorporated as requirements in all leases and should include a developer operated Park Plaza carpool program, pre-paid transit passes, high all day parking costs, and provision of limited employee parking. It should be noted however.that if only disincentives are provided, the primary effect will be to shift low occupancy Park Plaza bound auto trips to other parking facilities having less stringent operating characteristics. Parallel incentives are required to accomplish the actual shift in modal preference.

This program should be required for the 6 and 5 million alternatives, would be of very high value for the 4 million density, and would still provide significant benefits for the 3 and 2 million options.

D. Local Circulation

Restrictions to the efficient movement of vehicles on the local street circulation system should be avoided for all alternatives. This includes enforcement of illegal parking regulations, increased banning of on-street parking during peak hours, and removal of the Statler-Hilton hotel entrance from Arlington Street.

The proposed westbound connector - Eliot Street and new Providence Street - passing through Park Plaza will serve as both a primary egress route and a means of westbound movement for non-Park Plaza based trips. Accordingly, steps should be taken to avoid taxi standing, illegal parking, or any other condition that would reduce lane capacity on this connector, especially at times of peak travel. If this road is not free flowing, congestion effects could easily spread to other routes and also into the garage.

If either the 5 or 6 million sq. ft. designs are constructed, at least one major new east-west circulation route should be provided, combined with improved access to the Massachusetts Turnpike. To facilitate cross-town movement in the downtown and the South End, a system of turnpike frontage roads has been proposed by the B.R.A., extending from Dorchester Avenue and the Southeast Expressway to Dartmouth Street. This will involve a connection of Broadway with Marginal Road and an extension of Herald Street from Arlington Street to Dartmouth Street along with related street modifications. A new 3-lane Essex Street between Atlantic Avenue and Tremont Street (using Essex, Rowe Place, Exeter Place, and Avery Street) has also been proposed which would result in improved east-west circulation.

Movement of Park Plaza service related vehicles should be prohibited from peak periods of travel for the 4, 5, and 6 million sq. ft. density packages so that such vehicles do not act as a catalyst for additional congestion on either the local streets or the parking ramps.

The service road system should be re-designed to minimize unnecessary travel by service vehicles on local streets surrounding the Park Plaza site. For example, assuming only a single service entrance ramp is provided on the east end on Stuart Street with exit back onto Stuart at the west end, vehicles arriving from the western directions would have to use Berkeley, Boylston, Tremont, and Eliot Streets to arrive at the single entrance ramp. Analogously, service vehicles leaving for the west would utilize Stuart, Charles, and new Providence Streets. The primary problem is related to access and results directly from the planned traffic divider between Stuart and Eliot Streets. A 2-way service facility, if physically possible, is preferable from a local street circulation perspective to a single one-way loop.

Pedestrian accessibility both within and to the site area should be emphasized - especially for the 6, 5, and 4 million densities - with precautions taken to separate pedestrian and vehicular movements. While no analysis has been performed, provision for a grade separated pedestrian crossing of Boylston Street should help to alleviate traffic congestion by not reducing capacity of the Boylston-Tremont intersection. In addition, all pedestrian crossings of new Charles Street should be grade separated in order not to decrease the ability of this street to service outbound trips. Such pedestrian crossings also would help to achieve an east-west design continuity of Park Plaza.

E. Management of Work Hours

For the 5 and 6 million sq. ft. alternatives, it is recommended that a mandatory program of either flexible or staggered work hours be undertaken for all office employees where arrival-departure times can be distributed over at least a 2 hour period. This method of spreading the duration and lowering the magnitude of the two peak travel periods will further enhance the natural distribution over time of trip making resulting from the varied activity mix to be located within Park Plaza. This requirement should be incorporated into the leases for office occupants. For smaller firms, specific work times might be specified. Larger firms, however, would be able to vary the work hours of their own employees.

While not as essential, some control of work hours would also be helpful for the 4 and 3 million options as well.

The flexible hours option is preferable to staggered hours since it will result in more freedom for individual employees, will promote more effective carpool programs, and is more compatible with the type of employment likely to locate within Park Plaza.

F. Public Transportation

No additional mitigating measures relating to rapid transit, commuter rail, or bus service - other than those now planned and committed - is necessary since none of the proposed alternatives should cause ridership on these modes

to exceed scheduled capacity. There are, however, certain transit developments which, if implemented, would enhance the Park Plaza development. There also are possible transit improvements that, while not necessary, would either increase the attractiveness of M.B.T.A. service or result in still further capacity increases should this prove desirable.

A significant transportation improvement will result under all five alternatives from relocation and centralization of all inter-city bus and existing Park Square commuter bus operations to South Station as part of the relocation plan associated with acquisition of the Park Square parcel. This will help to alleviate traffic congestion by removing most buses from the immediate vicinity of Park Plaza. Such a change also will remove approximately 25% of the current pedestrian movement from the site area.

Improved connections could be provided between the Park Plaza site area and nearby M.B.T.A. stations. These could be in the form of pedestrian or moving sidewalk connections between Essex and Boylston stations or between Park Street and Boylston. They also could be in the form of minibus service connecting the new South Cove Station, Back Bay Station and South Station Terminal with Park Plaza, the Hancock Tower, and the Prudential Center.

While no definite plans now exist, the M.B.T.A. believes improvements to the existing Green Line are possible which would yield a further increase in scheduled capacity from 16,000 to 20,000 passengers per hour. These changes would include further upgrading of the power system, realignment of Copley Junction, electronic signalization, and additional new vehicles.

APPENDIX A

A.M. AND P.M. PEAK HOUR ANALYSIS RESULTS

VEHICLE AND PERSON VOLUMES BY MODE

SIX MILLION ALTERNATIVE

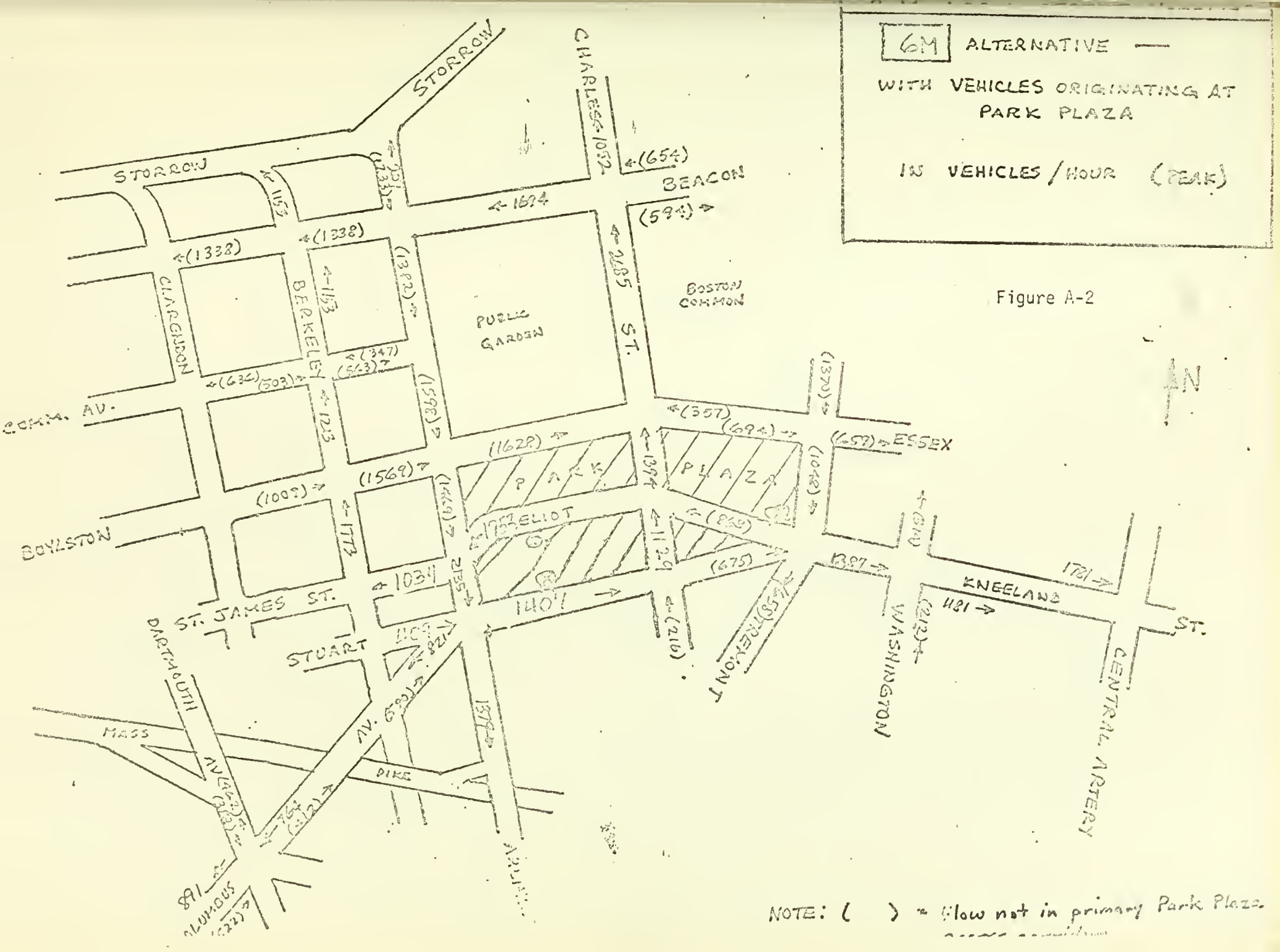

Figure A-2

NOTE: ( ) = flow not in primary Park Plaza access corridor

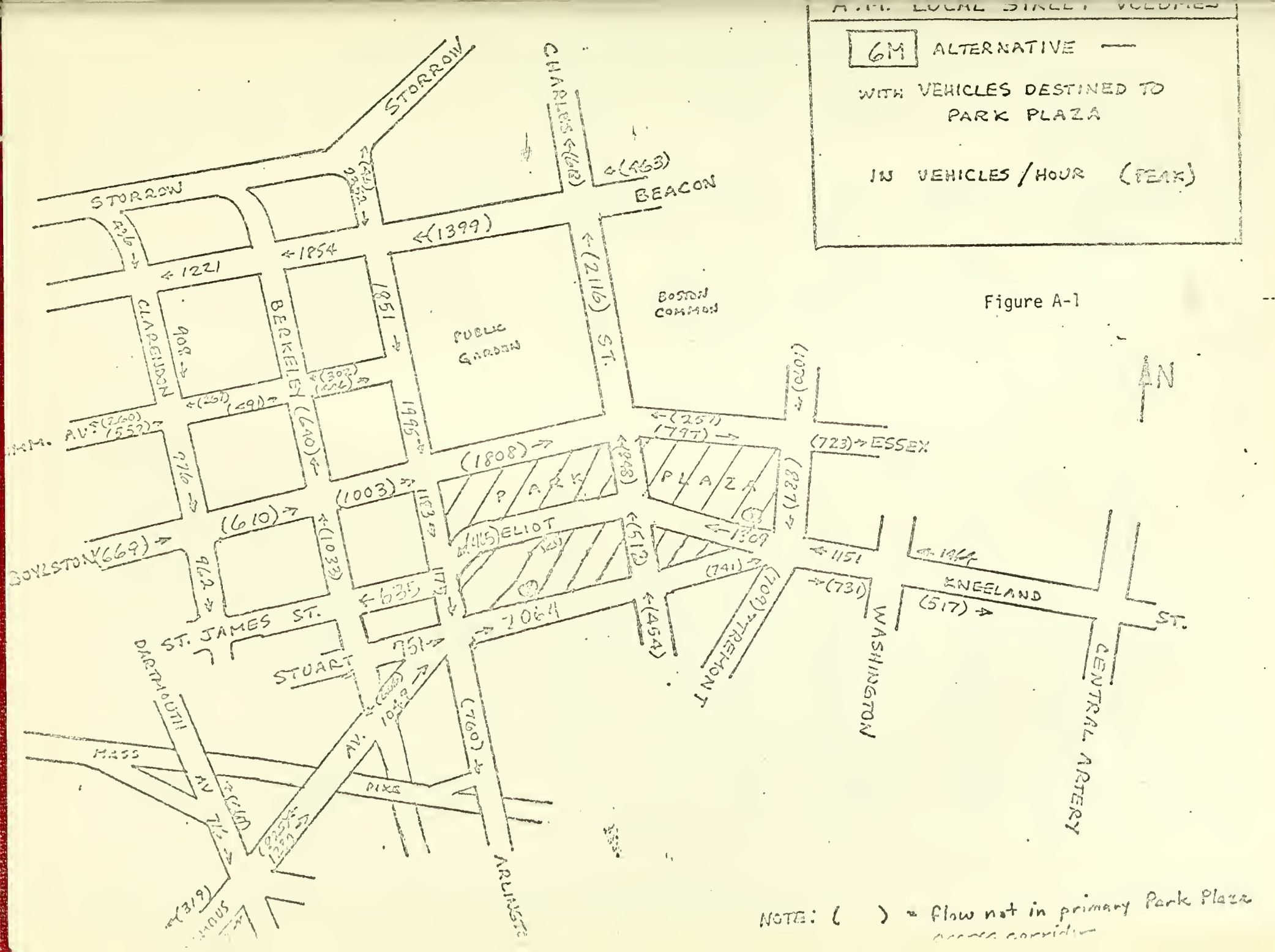
6M ALTERNATIVE
WITH VEHICLES DESTINED TO PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES (463)
BEACON
(1399)
1854
1221
BOSTON COMMON
PUBLIC GARDEN
CLARENDON
BERKELEY (640)
1851
(216) ST.
(1808)
PARK
PLAZA
(723) ESSEX
(797)
(1003)
(610)
BOYLSTON (669)
ELIOT
(1033)
635
ST. JAMES ST.
STUART
1064
(454)
(731)
WASHINGTON
KNEELAND
(517)
CENTRAL ARTERY
DARTMOUTH
MASS AV
PIKE
ARLINGTON
(760)
(319)
NOTE: ( ) = Flow not in primary Park Plaza access corridor

Figure A-1

TABLE A-1

A.M. Peak Hour Street Volumes-Vehicles Destined to Park Plaza*
Six Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	111	1141	9.7	1746	.72	.80
	Southbound	NW	91	345	26.3	876	.50	.54
Beacon-Arlington	Southbound	½ N	111	834	13.3	1440	.66	.73
	Westbound	½ N	111	1296	8.6	1680	.84	.94
Boylston - Clarendon	Southbound	NW, ½ N	202	624	32.4	1104	.75	.79
Boylston - Arlington	Southbound	½ N	111	1683	6.6	2208	.81	.92
Columbus-Arlington-Stuart	Southbound	½ N	111	989	11.2	816	1.35	1.50
	Eastbound	½ N, NW	202	450	44.9	420	1.55	1.62
	Northeast bound	SW, W	540	509	106.1	504	2.08	2.02
Washington - Stuart	Eastbound	NE, SE	599	654	91.6	1272	.99	.97
Dartmouth - Columbus	Southeast bound	W	276	440	62.7	552	1.29	1.32
	Northeast bound	SW	264	835	31.7	900	1.22	1.30
Commonwealth-Arlington	Southbound	½ N	111	1512	7.3	2160	.75	.85

(1) See Route Map for Corridor Location and Routing Through Intersections

P.M. Peak Hour Street Volumes-Vehicles Destined to Park Plaza*

Six Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	122	810	15.1	816	1.14	1.26
Beacon-Charles	Northbound	N	243	1615	15.0	2460	.76	.83
Boylston-Charles	Northbound	N	243	1004	24.2	1494	.83	.90
Columbus-Arlington-Stuart	Westbound	W, SW	666	530	125.6	816	1.47	1.40
Washington - Stuart	Eastbound	SE, NE	752	562	133.8	1488	.88	.84
Dartmouth-Columbus	Southwest bound	SW	327	437	74.8	756	1.01	1.01
Arlington - Mass Pike	Southbound	W	339	1416	23.9	2230	.79	.85
Beacon - Berkeley	Northbound	NW	113	1040	10.9	1104	1.04	1.17

(1) See route maps for corridor routings through intersections.

TABLE A-3

A.M. Peak Hour Transit Volumes-Trips Destined to Park Plaza

Six Million Sq. Ft. Alternative

		(1)	(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	637	7321	7958	8.7	16,000	.56
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1131	7300	8431	15.5	16,000	.58
Red (Harvard)	NW	305	7379	7684	4.1	20,900	.42
Red(So.Shore)	SE	464	11335	11799	4.1	20,900	.64
Blue	NE	396	7475	7871	5.3	10,000	.89
Orange (Hay)	N	401	6125	6526	6.5	11,900	.62
Orange (Forest Hill)	SW	514	8478	8992	6.1	11,900	.85

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-4

P.M. Peak Hour Transit Volumes-Trips Destined to Park Plaza

Six Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	1140	8100	9240	14.1	16,000	.64
Green (No. Sta.)	NW,SE, NE, .2 DNTN	1781	8100	9881	22.0	16,000	.67
Red (Harvard)	NW	379	9189	10198	3.9	20,900	.52
Red(So.Shore)	SE	585	13116	13701	4.5	20,900	.74
Blue	NE	486	7788	8274	6.2	10,000	.93
Orange (Hay)	N	472	7245	7717	6.5	11,900	.73
Orange (Forest Hill)	SW	637	9809	10446	6.5	11,900	.99

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

FIVE MILLION ALTERNATIVE

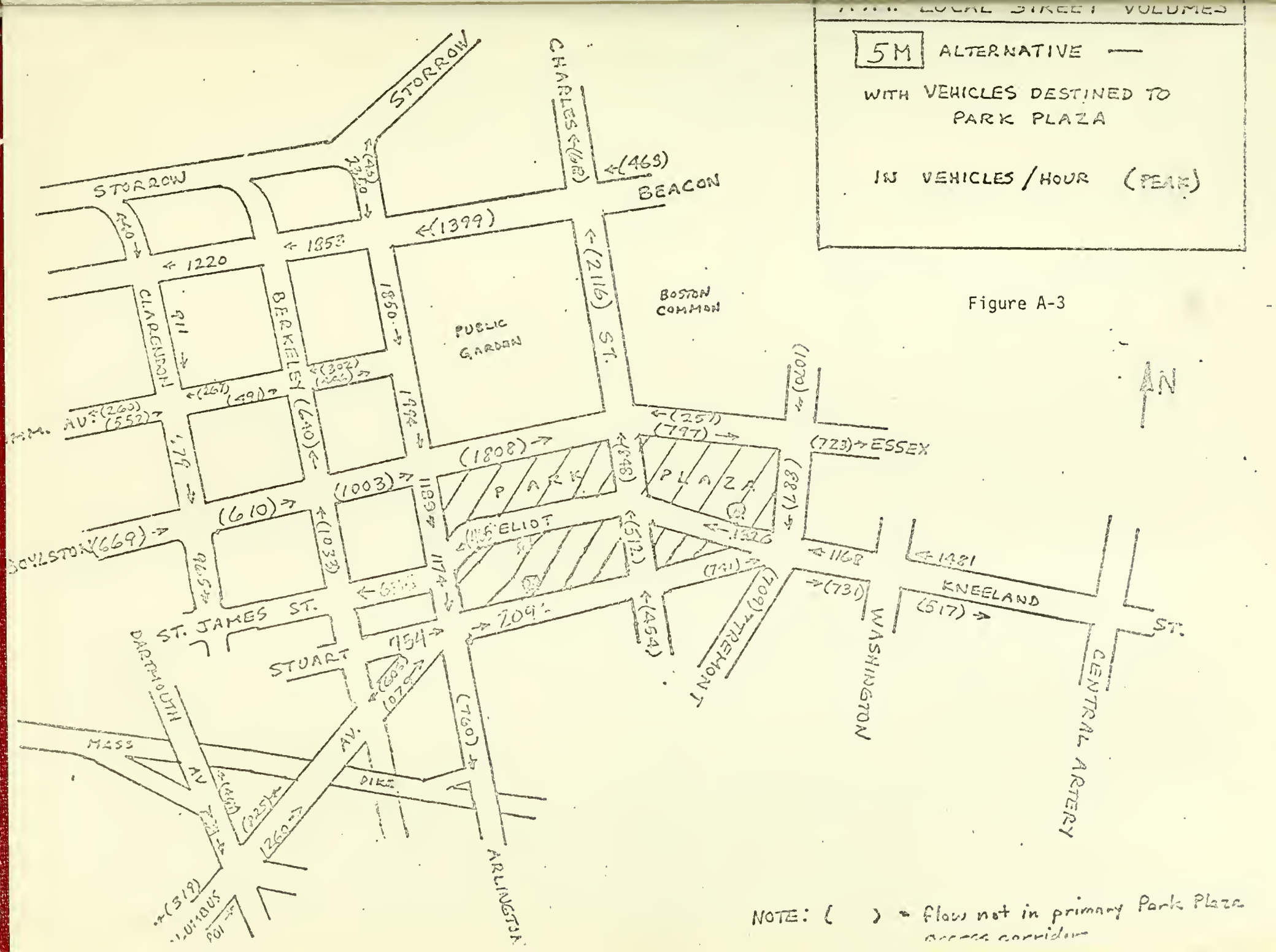
5M ALTERNATIVE
WITH VEHICLES DESTINED TO PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES
BEACON
BOSTON COMMON
PUBLIC GARDEN
CLARENDON
BERKELEY
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV.
DIKE
ARLINGTON
PARK
PLAZA
ELIOT
ESSEX
KNEELAND ST.
WASHINGTON
TREMONT
CENTRAL ARTERY
AN
NOTE: ( ) = Flow not in primary Park Plaza access corridor

Figure A-3

P.M. LOCAL STREET VOLUMES

5M ALTERNATIVE —

WITH VEHICLES ORIGINATING AT PARK PLAZA

IN VEHICLES/HOUR (PEAK)

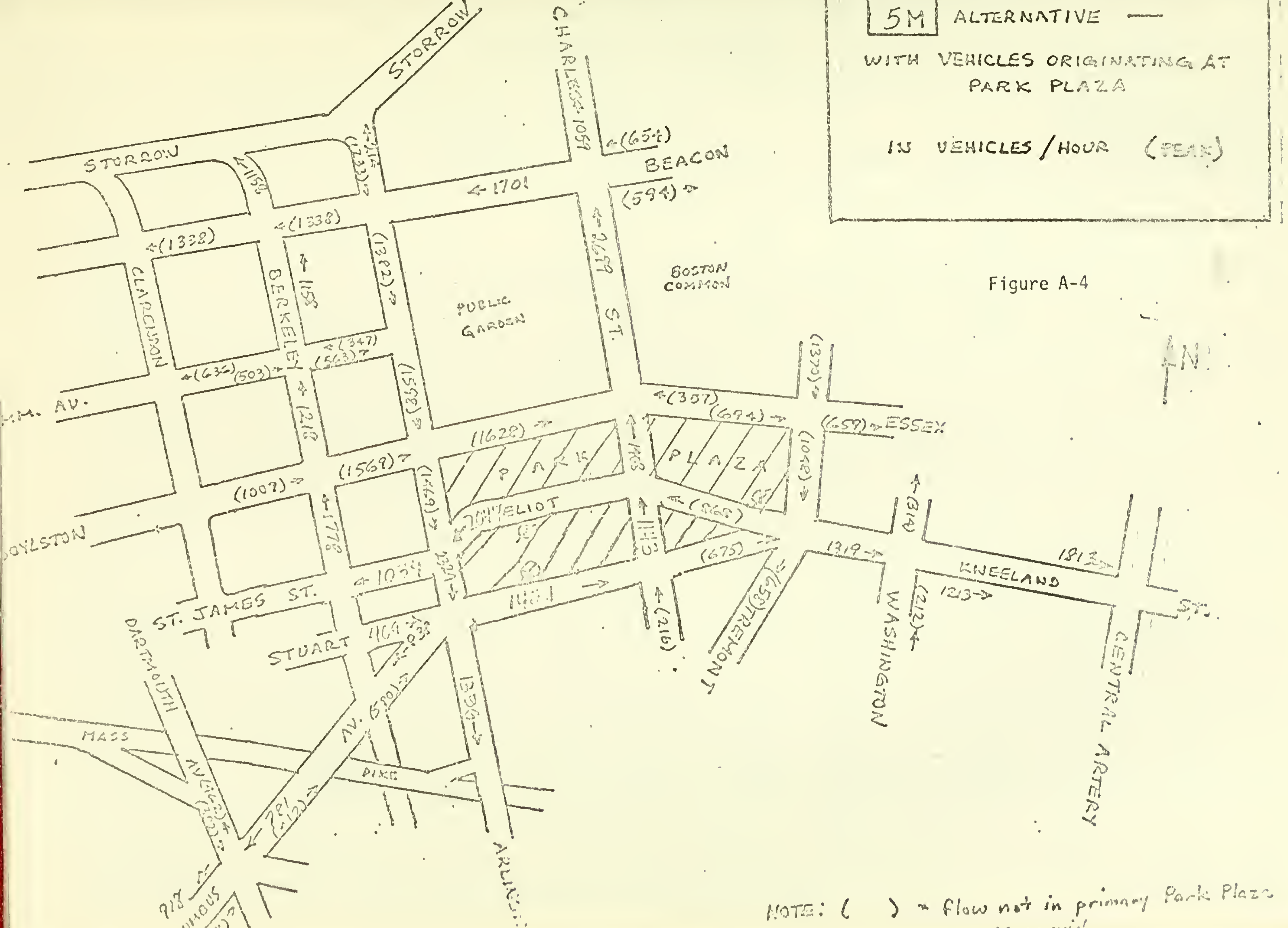

Figure A-4

NOTE: ( ) = flow not in primary Park Plaza

TABLE A-5

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Five Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles [1]	Existing Volume [2]	% Added [1]/[2]	Capacity (Veh/Hr) [3]	Vol/Cap'y w/Park Plaza ([1]+[2])/[3]	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	110	1141	9.6	1746	.72	.80
	Southbound	NW	95	345	27.5	876	.50	.54
Beacon-Arlington	Southbound	½ N	110	834	13.1	1440	.66	.73
	Westbound	½ N	110	1296	8.5	1680	.84	.94
Boylston - Clarendon	Southbound	NW, ½ N	205	624	32.9	1104	.75	.80
Boylston - Arlington	Southbound	½ N	110	1683	6.5	2208	.81	.92
Columbus-Arlington-Stuart	Southbound	½ N	110	989	11.1	816	1.35	1.50
	Eastbound	½ N, NW	205	450	45.5	420	1.56	1.62
	Northeast bound	SW, W	570	509	111.9	504	2.14	2.07
Washington-Stuart	Eastbound	NE, SE	616	654	94.2	1272	1.00	.98
Dartmouth-Columbus	Southeast bound	W	291	440	66.1	552	1.32	1.34
	Northeast bound	SW	279	835	33.4	900	1.24	1.32
Commonwealth-Arlington	Southbound	½ N	110	1512	7.3	2160	.75	.85

(1) See Route Map for Corridor Location and Routing Through Intersections

TABLE A-6

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Five Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	129	810	15.9	816	1.15	1.27
Beacon-Charles	Northbound	N	257	1615	15.9	2460	.76	.84
Boylston-Charles	Northbound	N	257	1004	25.6	1494	.84	.91
Columbus-Arlington-Stuart	Westbound	W, SW	855	530	161.3	816	1.69	1.59
Washington-Stuart	Eastbound	SE, NE	784	562	139.5	1488	.90	.86
Dartmouth-Columbus	Southwest bound	SW	344	437	78.7	756	1.03	1.03
Arlington-Mass Pike	Southbound	W	356	1416	25.1	2230	.79	.86
Beacon-Berkeley	Northbound	NW	118	1040	11.3	1104	1.05	1.17

(1) See route maps for corridor routings through intersections.

TABLE A-7

A.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza
Five Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	700	7321	8021	9.6	16,000	.56
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1411	7300	8711	19.3	16,000	.60
Red (Harvard)	NW	320	7379	7699	4.3	20,900	.42
Red(So.Shore)	SE	487	11335	11822	4.3	20,900	.64
Blue	NE	389	7475	7864	5.2	10,000	.89
Orange (Hay)	N	420	6125	6545	6.9	11,900	.62
Orange (Forest Hill)	SW	542	8478	9020	6.4	11,900	.86

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-8

P.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza
Five Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	1150	8100	9250	14.2	16,000	.64
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1854	8100	9954	22.9	16,000	.68
Red (Harvard)	NW	398	9189	9587	4.3	20,900	.52
Red(So.Shore)	SE	612	13116	13728	4.7	20,900	.75
Blue	NE	508	7788	8296	6.5	10,000	.94
Orange (Hay)	N	498	7245	7743	6.9	11,900	.73
Orange (Forest Hill)	SW	669	9809	10478	6.8	11,900	.99

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

FOUR MILLION ALTERNATIVE

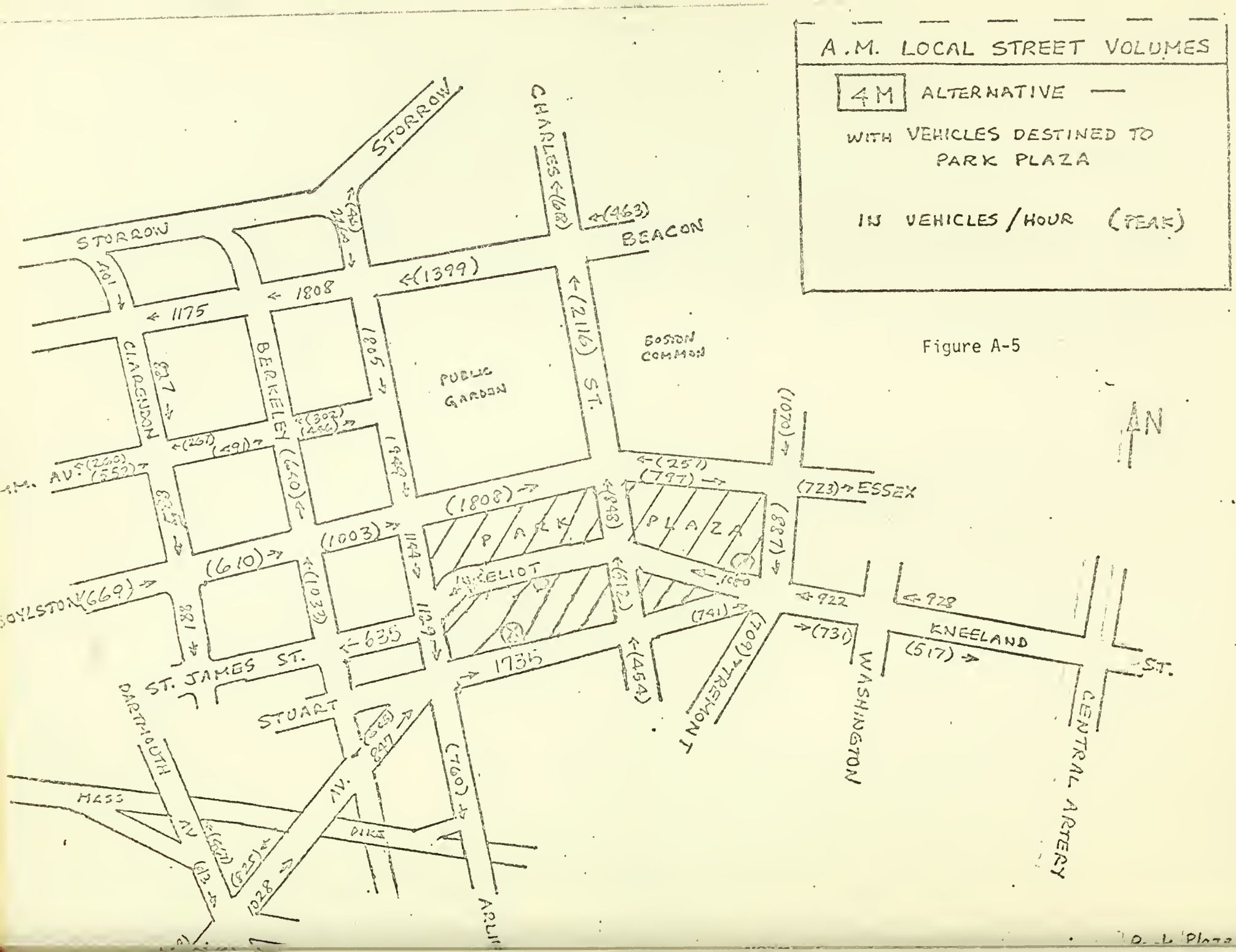
A.M. LOCAL STREET VOLUMES
4M ALTERNATIVE —
WITH VEHICLES DESTINED TO PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES
BEACON
BOSTON COMMON
PUBLIC GARDEN
CLARENDON
BERKELEY
ST.
PARK
PLAZA
ARLINGTON
ESSEX
BOYLSTON
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV
PIKE
ARLI
TREMONT
WASHINGTON
KNEELAND
CENTRAL ARTERY
4N

Figure A-5

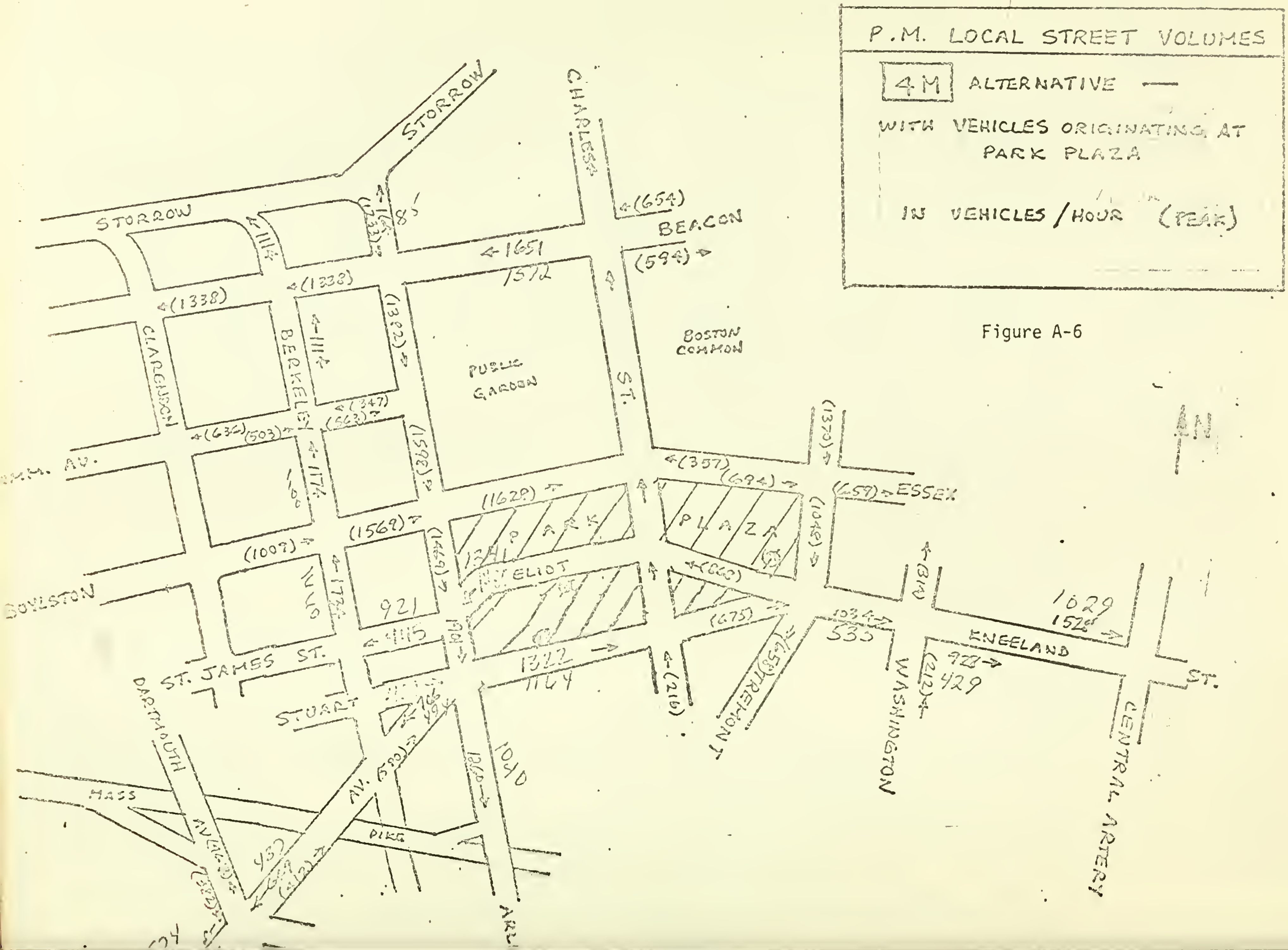
P.M. LOCAL STREET VOLUMES
4M ALTERNATIVE —
WITH VEHICLES ORIGINATING AT PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES ST.
BEACON
CLARENDON
BERKELEY
COMM. AV.
BOYLSTON
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV.
PIKE
ARL
PUBLIC GARDEN
BOSTON COMMON
PARK
PLAZA
ELIOT
ESSEX
TREMONT
WASHINGTON
KNEELAND
CENTRAL ARTERY
ST.
N
(654)
(594)
1651
1572
(1338)
(1338)
(1392)
(347)
(563)
(632)
(503)
(3651)
(1628)
(1569)
(1009)
(1469)
(357)
(694)
(1370)
(459)
(1048)
(660)
(675)
(216)
(212)
1034
535
1629
1520
928
429
1322
1164
1040
1260
1115
1734
921
1341
111
117
114
85

Figure A-6

TABLE A-9

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Four Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound Southbound	½ N NW	65 56	1141 345	5.7 16.2	1746 876	.69 .46	.78 .50
Beacon-Arlington	Southbound Westbound	½ N ½ N	65 65	834 1296	7.8 5.0	1440 1680	.62 .81	.70 .92
Boylston-Clarendon	Southbound	NW, ½ N	121	624	19.4	1104	.67	.74
Boylston-Arlington	Southbound	½ N	65	1683	3.9	2208	.79	.90
Columbus-Arlington-Stuart	Southbound Eastbound Northeast bound	½ N ½ N, NW SW, W	65 121 338	989 450 509	6.6 26.9 66.4	816 420 504	1.29 1.36 1.68	1.46 1.46 1.70
Washington-Stuart	Eastbound	NE, SE	370	654	56.6	1272	.81	.82
Dartmouth-Columbus	Southeast bound Northeast bound	W SW	173 165	440 835	39.3 19.8	552 900	1.11 1.11	1.17 1.21
Commonwealth-Arlington	Southbound	½ N	65	1512	4.3	2160	.73	.83

(1) See Route Map for Corridor Location and Routing Through Intersections

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Four Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	79	810	9.8	816	1.09	1.22
Beacon-Charles	Northbound	N	158	1615	9.8	2460	.72	.81
Boylston-Charles	Northbound	N	158	1004	15.7	1494	.78	.86
Columbus-Arlington-Stuart	Westbound	W, SW	432	530	81.5	816	1.18	1.17
Washington-Stuart	Eastbound	SE, NE	499	562	88.8	1488	.71	.70
Dartmouth-Columbus	Southwest bound	SW	212	437	48.5	756	.86	.89
Arlington-Mass Pike	Southbound	W	220	1416	15.5	2230	.73	.81
Beacon-Berkeley	Northbound	NW	74	1040	7.1	1104	1.01	1.14

(1) See route maps for corridor routing through intersections.

TABLE A-11

A.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza

Four Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	453	7321	7774	6.2	16,000	.55
Green (No. Sta.)	NW,SE,NE, .2 DNTN	857	7300	8157	11.7	16,000	.57
Red (Harvard)	NW	190	7379	7569	2.6	20,900	.41
Red(So.Shore)	SE	289	11335	11624	2.5	20,900	.64
Blue	NE	240	7475	7715	3.2	10,000	.88
Orange (Hay)	N	249	6125	6374	4.1	11,900	.61
Orange (Forest Hill)	SW	321	8478	8799	3.8	11,900	.84

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-12

P.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza

Four Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	815	8100	8915	9.1	16,000	.62
Green (No. Sta.)	NW,SE,NE, .2 DNTN	1200	8100	9300	12.9	16,000	.64
Red (Harvard)	NW	247	9189	9436	2.7	20,900	.52
Red(So.Shore)	SE	380	13116	13496	2.9	20,900	.74
Blue	NE	338	7788	8126	4.3	10,000	.92
Orange (Hay)	N	308	7245	7553	4.3	11,900	.72
Orange (Forest Hill)	SW	414	9809	10223	4.2	11,900	.98

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

THREE MILLION ALTERNATIVE

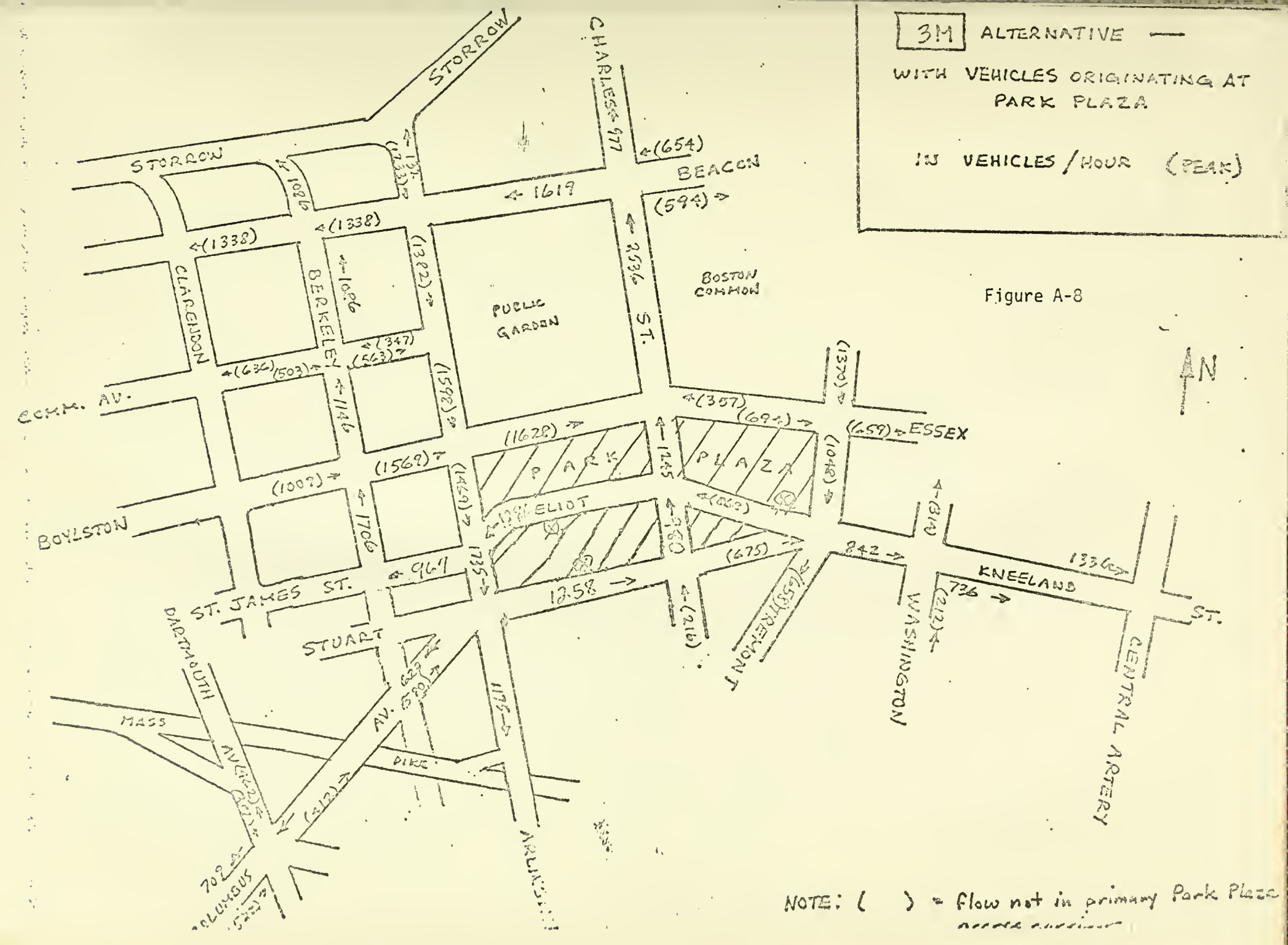
3M ALTERNATIVE
WITH VEHICLES ORIGINATING AT PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLESS 977
(654)
BEACON
1619
(594)
(1338)
(1338)
CLARENDON
BERKELEY
1096
(1233)
1801
(382)
PUBLIC GARDEN
BOSTON COMMON
2536
ST.
(347)
(563)
(634)
(503)
1144
(1593)
COMM. AV.
(370)
(357)
(694)
(459) ESSEX
(1628)
1245
PARK
PLAZ
(1040)
(1568)
(1459)
(1007)
ELIOT
(822)
BOYLSTON
1706
1785
(1314)
1336
KNEELAND
ST.
ST. JAMES ST.
967
1258
(675)
842
736
(212)
(216)
(1230)
WASHINGTON
CENTRAL ARTERY
DARTMOUTH
STUART
MASS
AV.
PIKE
(412)
ARLINGTON
702
COLUMBUS
N
NOTE: ( ) = flow not in primary Park Plaza access direction

Figure A-8

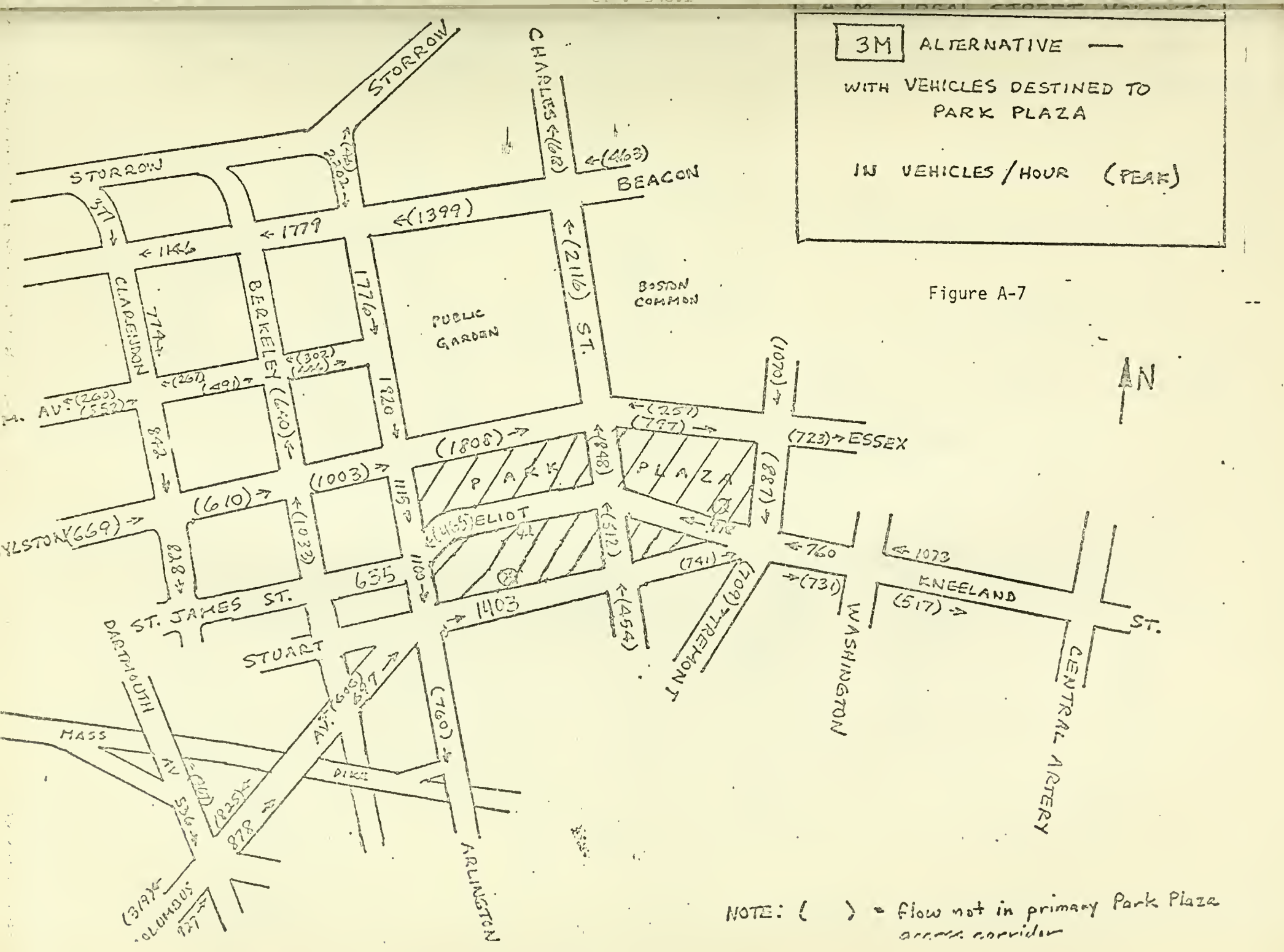
3M ALTERNATIVE —
WITH VEHICLES DESTINED TO PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES
BEACON
BOSTON COMMON
PUBLIC GARDEN
CLARENDON
BERKELEY
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV.
PARK
PLAZA
ELIOT
ESSEX
KNEELAND ST.
WASHINGTON
TREMONT
CENTRAL ARTERY
ARLINGTON
N
NOTE: ( ) = flow not in primary Park Plaza access corridor

Figure A-7

TABLE A-13

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Three Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	36	1141	3.2	1746	.67	.77
	Southbound	NW	32	345	9.3	876	.43	.48
Beacon-Arlington	Southbound	½ N	36	834	4.3	1440	.60	.69
	Westbound	½ N	36	1296	2.8	1680	.79	.90
Boylston-Clarendon	Southbound	NW, ½ N	68	624	10.9	1104	.63	.70
Boylston-Arlington	Southbound	½ N	36	1683	2.1	2208	.78	.89
Columbus-Arlington-Stuart	Southbound	½ N	36	989	3.6	816	1.26	1.43
	Eastbound	½ N, NW	68	450	15.1	420	1.23	1.36
	Northeast bound	SW, W	188	509	36.9	504	1.38	1.46
Washington-Stuart	Eastbound	NE, SE	208	654	31.8	1272	.68	.72
Dartmouth-Columbus	Southeast bound	W	96	440	21.8	552	.97	1.06
	Northeast bound	SW	92	835	11.0	900	1.03	1.15
Commonwealth-Arlington	Southbound	½ N	36	1512	2.4	2160	.72	.82

(1) See Route Map For Corridor Location and Routing Through Intersections

TABLE A-14

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Three Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	47	810	5.8	816	1.05	1.19
Beacon-Charles	Southbound	N	94	1615	5.8	2460	.69	.79
Boylston-Charles	Southbound	N	94	1004	9.4	1494	.73	.82
Columbus-Arlington-Stuart	Southbound	W, SW	266	530	50.0	816	.98	1.01
Washington-Stuart	Eastbound	SE, NE	307	562	54.6	1488	.58	.60
Dartmouth-Columbus	Southwest bound	SW	131	437	30.0	756	.75	.80
Arlington-Mass Pike	Southbound	W	135	1416	9.5	2230	.70	.78
Beacon-Berkeley	Northbound	NW	46	1040	4.4	1104	..98	1.12

(1) See route maps for corridor routings through intersections.

TABLE A-15

A.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza
Three Million Sq. Ft. Alternative

		(1)	(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	325	7321	7646	4.4	16,000	.54
Green (No. Sta.)	NW,SE, NE .2 DNTN	498	7300	7798	6.8	16,000	.55
Red (Harvard)	NW	108	7379	7487	1.4	20,900	.41
Red(So.Shore)	SE	163	11335	11498	1.4	20,900	.63
Blue	NE	132	7475	7607	1.8	10,000	.87
Orange (Hay)	N	137	6125	6262	2.2	11,900	.60
Orange (Forest Hill)	SW	180	8478	8658	2.1	11,900	.83

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-16

P.M. Peak Hour Transit Volumes - Trips Destined to Park Plaza

Three Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	562	8100	8662	6.5	16,000	.61
Green (No. Sta.)	NW,SE,NE .2 DNTN	592	8100	8692	7.3	16,000	.61
Red (Harvard)	NW	154	9189	9343	1.6	20,900	.51
Red(So.Shore)	SE	238	13116	13354	1.8	20,900	.73
Blue	NE	200	7788	7988	2.6	10,000	.91
Orange (Hay)	N	184	7245	7429	2.3	11,900	.71
Orange (Forest Hill)	SW	257	9809	10066	2.6	11,900	.97

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TWO MILLION ALTERNATIVE

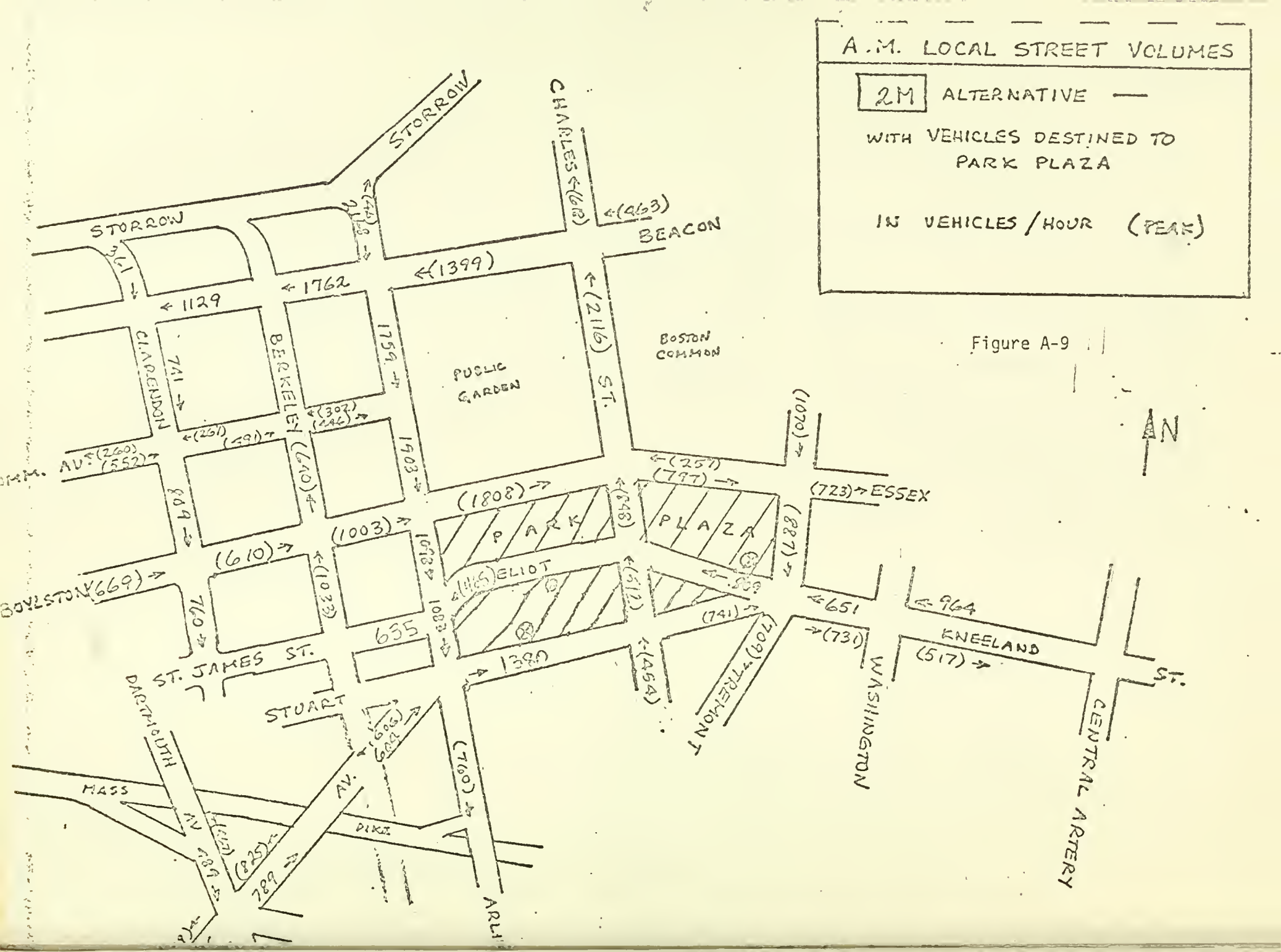
A.M. LOCAL STREET VOLUMES
2M ALTERNATIVE —
WITH VEHICLES DESTINED TO PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES
BEACON
BOSTON COMMON
PUBLIC GARDEN
CLARENDON
BERKELEY
ESSEX
PARK
PLAZA
ELIOT
BOYLSTON
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV.
PIKE
ARLI
TREMONT
WASHINGTON
KNEELAND
CENTRAL ARTERY
N

Figure A-9

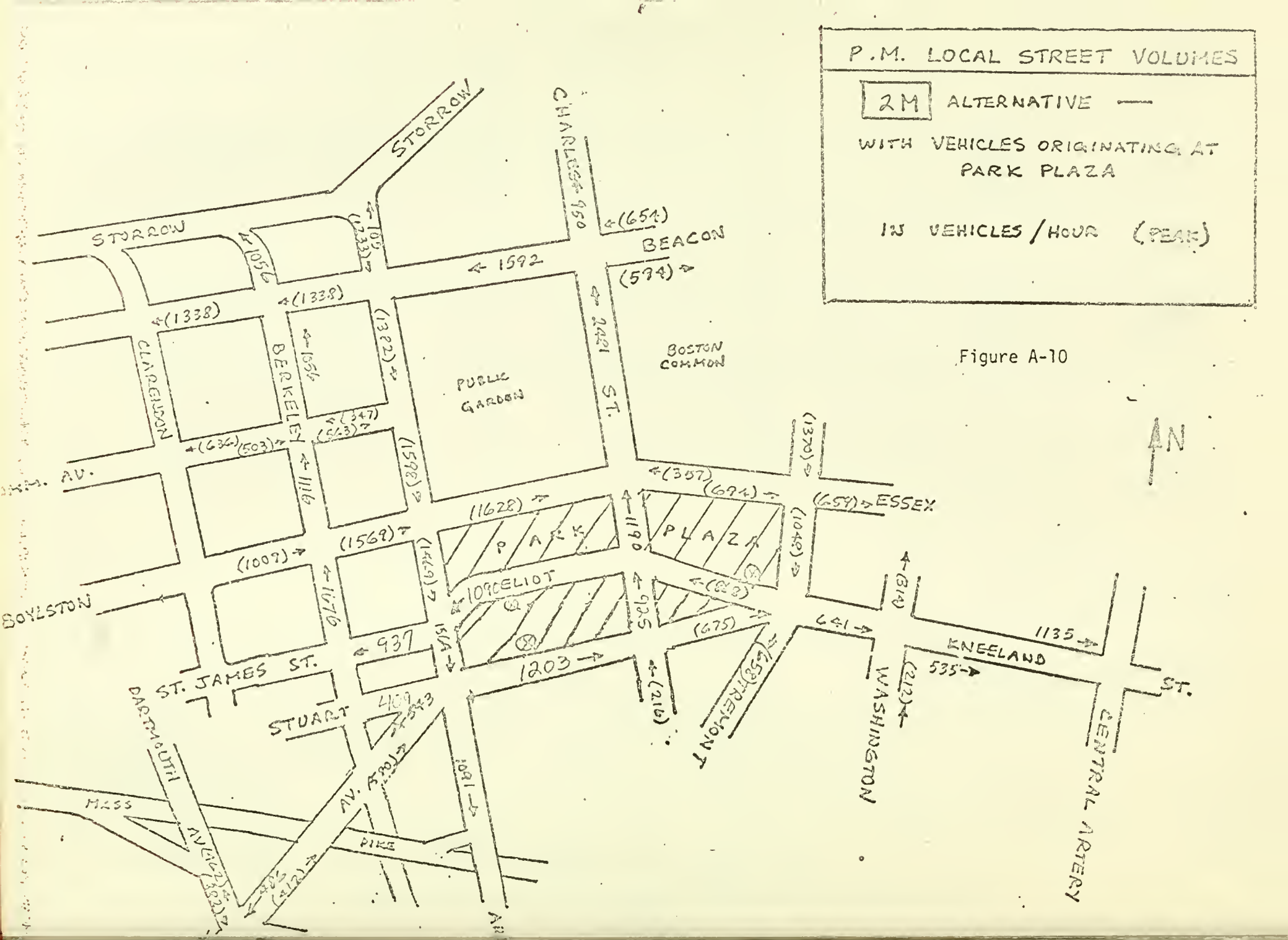
P.M. LOCAL STREET VOLUMES
2M ALTERNATIVE
WITH VEHICLES ORIGINATING AT PARK PLAZA
IN VEHICLES / HOUR (PEAK)
STORROW
CHARLES
BEACON
BOSTON COMMON
PUBLIC GARDEN
CLARENDON
BERKELEY
ST. JAMES AV.
BOYLSTON
ST. JAMES ST.
STUART
DARTMOUTH
MASS AV.
PARK
PLAZA
ESSEX
AGASSIZ
ELIOT
KNEELAND
WASHINGTON
TREMONT
CENTRAL ARTERY
PIKE
N

Figure A-10

TABLE A-17

A.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*

Two Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	Total Park Plaza Vehicles [1]	Existing Volume [2]	% Added [1]/[2]	Capacity (Veh/Hr) [3]	Vol/Cap'y w/Park Plaza ([1]+[2])/[3]	Adjusted Volumes Vol/Cap'y
Beacon-Clarendon	Westbound	½ N	19	1141	1.7	1746	.66	.76
	Southbound	NW	16	345	4.6	876	.41	.47
Beacon-Arlington	Southbound	½ N	19	834	2.3	1440	.59	.68
	Westbound	½ N	19	1296	1.5	1680	.78	.90
Boylston-Clarendon	Southbound	NW, ½ N	35	624	5.6	1104	.60	.68
Boylston-Arlington	Southbound	½ N	19	1683	1.1	2208	.77	.88
Columbus-Arlington-Stuart	Southbound	½ N	19	989	1.9	816	1.24	1.41
	Eastbound	½ N, NW	35	450	7.8	420	1.15	1.30
	Northeast bound	SW, W	95	509	18.7	504	1.20	1.31
Washington-Stuart	Eastbound	NE, SE	99	654	15.1	1272	.59	.65
Dartmouth-Columbus	Southeast bound	W	49	440	11.1	552	.89	.99
	Northeast bound	SW	46	835	5.5	900	.98	1.11
Commonwealth-Arlington	Southbound	½ N	19	1512	1.3	2160	.71	.81

(1) See Route Map For Corridor Location and Routing Through Intersections.

TABLE A-18

P.M. Peak Hour Street Volumes - Vehicles Destined to Park Plaza*
Two Million Sq. Ft. Alternative

Intersection	Direction	Corridors Using This Intersection	[1] Total Park Plaza Vehicles	[2] Existing Volume	[1]/[2] % Added	[3] Capacity (Veh/Hr)	([1]+[2])/[3] Vol/Cap'y w/Park Plaza	Adjusted Volumes Vol/Cap'y
Beacon-Arlington	Westbound	N	20	810	2.5	816	1.02	1.16
Beacon-Charles	Northbound	N	39	1615	2.4	2460	.67	.77
Boylston-Charles	Northbound	N	39	1004	3.9	1494	.70	.79
Columbus-Arlington-Stuart	Westbound	W, SW	100	530	18.9	816	.77	.85
Washington-Stuart	Eastbound	SE, NE	106	562	18.9	1488	.45	.49
Dartmouth-Columbus	Southwest bound	SW	49	437	11.2	756	.64	.72
Arlington-Mass Pike	Southbound	W	51	1416	3.6	2230	.66	.75
Beacon-Berkeley	Northbound	NW	16	1040	1.5	1104	.96	1.10

(1) See route maps for corridor routing through intersections.

TABLE A-19

A.M. Peak Hour Transit Volume - Trips Destined to Park Plaza

Two Million Sq. Ft. Alternative

		(1)	(2)	(1)+(2)	(1)/(2)	(3)	
Line	Access Corridors Using This Line	Total Park Plaza Trips	Existing Volume	Total Volume	% Added	Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	156	7321	7477	2.1	16,000	.53
Green (No. Sta.)	NW,SE,NE .2 DNTN	239	7300	7539	3.3	16,000	.54
Red (Harvard)	NW	53	7379	7432	0.7	20,900	.41
Red(So.Shore)	SE	80	11335	11415	0.7	20,900	.63
Blue	NE	61	7475	7536	0.8	10,000	.87
Orange (Hay)	N	71	6125	6196	1.1	11,900	.60
Orange (Forest Hill)	SW	90	8478	8568	1.0	11,900	.83

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

TABLE A-20

P.M. Peak Hour Transit Volume - Trips Destined to Park Plaza

Two Million Sq. Ft. Alternative

Line	Access Corridors Using This Line	(1) Total Park Plaza Trips	(2) Existing Volume	(1)+(2) Total Volume	(1)/(2) % Added	(3) Scheduled Capacity	Adjusted Flows Vol/Cap'y
Green (Copley)	.8 DNTN, W	295	8100	8395	3.6	16,000	.597
Green (No. Sta.)	NW,SE,NE .2 DNTN	289	8100	8389	3.6	16,000	.597
Red (Harvard)	NW	57	9189	9246	0.6	20,900	.508
Red(So.Shore)	SE	85	13116	13201	0.6	20,900	.725
Blue	NE	65	7788	7853	0.8	10,000	.901
Orange (Hay)	N	76	7245	7321	1.0	11,900	.705
Orange (Forest Hill)	SW	96	9809	9905	1.0	11,900	.954

* North Station Commuter Rail Passengers Divided Equally Between Green and Orange Lines

APPENDIX B

PARKING GARAGE DEMAND ANALYSIS

TABLE B-1

Parking Garage Demand Analysis

6M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No. Veh	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	2242	0	1570	2018	2242	1682	673	0
Non-Employees	2002	0	200	200	600	500	300	200
Hotel	400	400	240	80	120	200	200	400
Residents	800	800	480	320	320	560	640	800
Total Demand	5444	1200	2490	2618	3282	2942	1813	1400
No. Parking Spaces Available		3131	3131	3131	3131	3131	3131	3131
Excess (+) or Deficiency (-)		+1931	+641	+513	-151	+189	+1318	+1731

TABLE B-2

Parking Garage Demand Analysis

5M Alternative
Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	2301	0	1611	2071	2301	1726	690	0
Non-Employees	2087	0	209	209	626	522	313	209
Hotel	406	406	244	81	122	203	203	406
Residents	542	542	325	217	217	379	434	542
Total Demand		948	1939	2578	3266	2830	1640	1157
No. Parking Spaces Available		2056	2056	2056	2056	2056	2056	2056
Excess (+) or Deficiency (-)		+1108	+ 117	-552	-1210	- 774	+416	+899

TABLE B-3

Parking Garage Demand Analysis

4M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	1703	0	1192	1533	1703	1277	511	0
Non-Employees	1613	0	161	161	484	403	242	161
Hotel	406	406	244	81	122	203	203	406
Residents	995	995	597	398	398	697	796	995
Total Demand		1401	2194	2173	2707	2580	1752	1562
No. Parking Spaces Available		1575	1575	1575	1575	1575	1575	1575
Excess (+) or Deficiency (-)		+174	-619	-598	-1132	-1005	-177	+13

TABLE B-4

Parking Garage Demand Analysis

3M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	1370	0	959	1233	1370	1028	411	0
Non-Employees	1746	0	175	175	524	437	262	175
Hotel	203	203	122	41	61	102	102	203
Residents	750	750	450	300	300	525	600	750
Total Demand		953	1706	1749	2255	2092	1375	1128
No. Parking Spaces Available		1395	1395	1395	1395	1395	1395	1395
Excess ( ) or Deficiency (-)		+442	-311	-354	-860	-697	+20	+267

TABLE B-5

Parking Garage Demand Analysis

2M Alternative

Vehicle Occupancy by Time of Day

Activity Type	No.Veh.	6 AM	9 AM	12 noon	3 PM	4:30 PM	6 PM	9 PM
Employees	963	0	674	867	963	722	289	0
Non-Employees	87	0	9	9	26	22	13	9
Hotel	0	0	0	0	0	0	0	0
Residents	320	320	192	128	128	224	256	320
Total Demand		320	875	1004	1117	968	558	329
No. Parking Spaces Available		1400	1400	1400	1400	1400	1400	1400
Excess (+) or Deficiency (-)		+1080	+525	+396	+283	+432	+842	+1071

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